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GENERAL ARTICLES

INFECTION AND DISEASE WITH SPECIAL REFERENCE TO TUBERCULOSIS*

By Frederick Heaf

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The state of normal good health may be disturbed by a number of factors. Illness may arise through abnormal development, improper nutrition, injury, or through living in an unsuitable environment, but by far the commonest cause of ill-health is infection by harmful or so-called pathogenic micro-organisms. The ubiquitous distribution of these throughout the inhabited world causes astonishment that the human body should survive for an average period of three-score years and ten the constant invasion by so many of these potential carriers of disease. It does not require much imagination or thought to realise that there must be forces at work within the body that resist and often overcome the harmful effects of these bacteria, otherwise no child could withstand the myriads of germs with which it comes into contact during the first few years of life. But the resistance offered by the body is not the same in all individuals, neither do all germs possess similar harmful characteristics. These two variables make the problem of infection intricate and complex, so that the development of disease following infection depends on a number of factors that vary from germ to germ, and from individual to individual.

Let us see what constitutes the defensive powers of the body. First there is the inherent or native resistance to infection that all body cells possess to a varying degree. The strength of this resistance, which is an intrinsic part of the constitution of every individual, depends on heredity and nurture, and varies with age and sex. It is also probably influenced by the secretions of certain ductless glands. Closely allied to this inherent or native resistance is the power of the tissues to develop a specific resistance to the particular organism that is invading them at any one time. This is usually known as acquired resistance, and is of great importance in suppressing the multiplication of the specific infecting organism with which it is associated, and also in pre-

* Abridged inaugural address by Professor Heaf, the new David Davies Professor of Tuberculosis, in the Welsh National School of Medicine, University of Wales, Cardiff.

venting the spread of the infection through the body. Acquired resistance takes a certain time to develop, and it may be that the tissues, during the period in which it is developing, are actually more vulnerable than at any other time, but once the acquired resistance has developed, it enhances the inherent or native resistance, and thereby gives the infected person a better chance of preventing the development of the particular disease. The power to develop this acquired resistance depends on the nutrition of the tissue, particularly with respect to vitamins. It also depends on the age of the individual, it being usually much less pronounced in infants and in the undernourished than in adults and well-nourished persons. The resistance that a body can put up against infection is, therefore, the sum total of the inherent resistance that is born with the individual, plus the acquired specific resistance that develops as a result of the infection. It would take too long to enter into a discussion on what constitutes "resistance to infection," and I am afraid we are all guilty of using that term rather loosely. Let it suffice that it comprises the power of the body cells to form substances that are antagonistic to the invading organism—substances which prevent their multiplication and eventually cause their death. In some instances it also includes the production of substances which neutralise the poisons arising from the infecting bacteria. The way in which these antibodies and antitoxins are formed, and the way in which they overcome bacteria, is indeed a complex subject which I must leave to abler persons than myself to explain.

A third factor that sometimes influences the result of infection by bacteria is that the invading organism may not be able to exist side by side with other infecting organisms if they are present in the body concurrently. Much research work is needed in this direction. Some support of this hypothesis is afforded by the frequency with which highly virulent streptococci may be present in the throats of tuberculous patients without giving rise to constitutional symptoms. Similarly there is some evidence that the reason why certain rats develop only a benign form of tuberculosis, after infection with virulent tubercle bacilli, is because they carry other organisms of the bartonella group that are antagonistic to the tubercle germ. On the other hand, certain other organisms seem to favour the development of tuberculosis. It is noteworthy how frequently in the African native a tuberculous lesion breaks down after he is infested by those many other parasites that abound in tropical countries. This is probably due to the parasites lowering resistance to the tubercle bacilli with which he was previously infected. These observations have not been fully investigated, but they are worthy of attention, for therein may lie a successful line of preventing or maybe of treating the disease.

It is reasonably certain that the powers of the body tissues to resist invasion of micro-organisms are influenced by chemical or biological substances. It is easy to appreciate that if any compound decreases the vitality of the tissues it will naturally reduce its powers to resist infection, so that tissues subjected to a poison either by ingestion, inhalation or injection are most likely to become further damaged if infected with harmful organisms. There are other substances that seem to increase the resistance of the body tissues, and when these can be brought to the site of infection by the blood, or carried by the lymph stream, they are valuable therapeutic agents. It is always difficult to determine

whether these substances are beneficial because they have a direct action on the bacteria, or whether they stimulate the cells of the body to produce substances that are lethal to them. It may be that there is an electrical potential between the bacteria and the cells, and that this is influenced by these compounds, so that the bacteria are attracted to certain cells which have phagocytic powers and are thereby able to destroy the organisms. It will be seen that the host is not a passive agent in the drama of infection. That there is always a cellular response to living protein, in the form of bacteria, is manifest by the production of substances that counteract the harmful effects of the toxic products of the micro-organisms. But there is another important change that occurs in tissues as a result of infection.

In most instances, after the first infection with a particular germ, the tissues become for a time allergic to that organism. This means that for a period, varying with the type of organism, the tissues are alert to subsequent invasions. Accompanying this alertness or sensitivity, although not necessarily synonymous with it, is the acquired resistance or immunity that has been mentioned previously. It is important not to confuse this sensitivity to a particular organism with the resistance or immunity that usually develops with it. It is rare to find sensitivity without some degree of immunity, but it is not infrequent to find immunity without sensitivity or so-called allergy. The duration of this sensitivity, or allergy, after infection varies with the virulence of the organism and the inherent resistance of the individual. It is an important factor in determining the course of the disease that may result from infection, and one to which in the past we have not paid sufficient attention. I think that its control is important in treatment as it influences the type of lesion that follows infection.

If we agree that the development of specific resistance is stimulated by infection with certain bacteria, we must take care that when we attempt segregation and protection of the individual against infection we compensate by other means the loss of any acquired resistance that would have been gained from virulent infection. This compensation usually takes the form of giving a preventive or prophylactic vaccine. In other words, it is wise not to neglect the condition of the soil in our effort to control the scattering of the seed of the weeds, otherwise the good seed that we wish to grow will not flourish.

It is generally agreed that in tuberculosis external factors influence the incidence of the disease, but the manner in which they do so is not clear. Unfortunately, material civilisation, as we have constituted it, tends to favour the development of disease because of the strain and stress imposed on communities of modern States by war, mass production, drugs and low standard living conditions. We know many of these factors that are harmful to our existence, and also those which are conducive to good health. It therefore remains in the hands of man to take all precautions to prevent his habits and mode of life reducing to nought that precious faculty of inherent resistance that is his chief protection against the development of disease.

The Problem in Tuberculosis

Tuberculosis is one of the best examples of a condition in which a clear distinction can be made between infection and disease. This is fortunate, as confusion between these two states can be the cause of unnecessary administra-

tion and individual hardship. In tuberculosis we have a further example of the interdependence of human and social pathology, and the eradication of the disease depends more upon rectifying defects in the social background of the community than upon the curative skill of the physician. The past is strewn with the wreckage of lives broken by a victory of the tubercle bacillus over the defence mechanism of the body. Such a victory is often made possible by the victim's disregard of fundamental rules of healthy living and the acquisition of bad habits that slowly undermine the immunity-producing powers inherent to a varying degree in all the races of man. Although there is evidence that resistance to tuberculous infection varies from race to race, there is also evidence that when the infection is indigenous in a country over a long period the average level of inherent or native resistance is raised, and then the primary infection can take place without causing serious constitutional symptoms. The adult population thereby acquires, quite unconsciously, a high inherent resistance to the infection. When this has been acquired and a high standard of living is maintained, active disease will develop in adults only after a heavy primary infection or a massive reinfection. When disease develops in these individuals with high native resistance, it is of a chronic type that progresses very slowly without causing much constitutional disturbance or disability. Such individuals, however, often spread virulent tubercle bacilli by coughing and sneezing, and are thereby a menace to infants and young adults who have not previously been infected. This tendency of tuberculosis to develop in successive generations of a community into a chronic disease, although it may be of advantage to patients in countries where the standard of living is high, presents a very difficult and serious public health problem where conditions of overcrowding, undernourishment and unhygienic habits prevail. It is probably one of the most formidable long-term administrative problems in public health that has to be faced in our own colonies.

In some of these the birth rate is increasing by leaps and bounds and may be as much as twice the death rate, and overcrowding is therefore reaching phenomenal proportions. In such places it is not unusual to find that thirty or even forty people are living in one small house, and in some races it is the custom for most of the members of the family to sleep in one poorly ventilated room for safety from either human or spiritual intruders. In most of these races the individual resistance to the disease is low, particularly during infancy and at the age of adolescence. This is because either the individual has not been previously infected, or very probably in the adolescent such resistance as has been acquired from a primary infection has been reduced by super-infection with the many parasites that are encountered, particularly in swampy undeveloped areas. The disease, therefore, assumes an acute form and progresses rapidly to a fatal issue. The short duration of the disease means that the period of infectivity is also short. If in the future the racial resistance to the disease is raised, and the character of the lesions changes to the chronic fibrotic type, the duration of the disease will be increased and thereby the period of infectivity of each tuberculous person will be considerably lengthened. It follows that unless the overcrowding is relieved, and the general standard of living raised, a much larger percentage of the population will be exposed to continuous infection than at present. The main approach, therefore, to the tuber-

culosis problem in such countries lies in general health measures that will succeed in reducing the incidence of parasitic infections by good drainage and a clean water supply, coupled with better housing, better nutrition and, last but not least, a higher educational standard that will abolish unhygienic customs founded on ignorance and superstition. On the other hand, whilst we establish more efficient public health measures and thereby save the lives of infants and young adults from dying from tuberculosis, the population will increase in areas where it is even now difficult to provide sufficient food for the existing community. These problems have to be faced and can only be solved by uniform progress on all fronts, so that health, economic development and education march forward together and at the same pace.

Although biological changes in races do not take place rapidly, anti-tuberculosis campaigns must be planned to avoid circumstances so easily created in which there are a large number of partially recovered patients who are sources of infection to the susceptible members of the community. Such circumstances can develop insidiously. We must therefore continually take the necessary precautions to protect all healthy members of the population. Although more patients at the present time are being rendered non-infectious by efficient treatment than ever before, the treatment and cure of tuberculosis is still a matter of considerable uncertainty, and it is true to say that the eradication of tuberculosis will not be achieved by our activities in the operating theatre and hospital ward, however necessary these may be for the recovery of the patient suffering from the disease.

The Complicity of the Tuberculosis Problem

The eradication of tuberculosis, or even the reduction of the incidence to an insignificant figure, is no simple matter. Two facts must always be kept in mind when planning schemes—first, that as the infection passes through successive generations the disease it produces becomes more and more chronic in character; and, secondly, that non-infected individuals are more susceptible to the infection than those who have recovered from their first infection.

The situation in Great Britain in this respect is becoming most complex. Owing to our inability to use all the tuberculosis beds in the country there are a large number of infectious patients outside our hospitals and institutions, many living under conditions of overcrowding, but not of poverty or malnutrition. Owing to recent advances in treatment, the expectancy of life of the tuberculous person is being increased. But from surveys in various parts of the country there is evidence that the age at which the majority of persons receive their primary infection with virulent tubercle bacilli is higher than in the past, which means there are more non-infected persons in the earlier age groups. Hence we are approaching that undesirable state of affairs of an increasing number of persons who are highly susceptible to tuberculosis with an increasing opportunity for them to come into contact with virulent infection. And yet, in spite of all these seemingly unfavourable circumstances, the mortality from tuberculosis of all forms has fallen more rapidly during the past two years than at any time in the previous two decades, and shows every sign of falling farther in the future. The complacent person will say, Why bother

when fewer persons are dying of tuberculosis, and the majority of sufferers are living longer?

The usual answer is that there are still 400 persons per week dying of this disease. This is of course a matter of great concern, but one is surprised to see this figure continually quoted without any relation to previous death rates, or to the mortality figures of other diseases. Serious as the figure may be, there is comfort in the fact that it is falling. Far more alarming is the fact that approximately 140,000 persons suffering from active tuberculosis are at large among the population of England and Wales, and that this figure is rising. All of these persons are potential sources of infection and a menace to non-infected individuals, particularly infants and adolescents. The days have long passed when governments met such a situation by employing armed robbers to steal the sacred body of St. Roch from its shrine at Montpellier, as did the Doge of Venice in the fifteenth century to protect his city from the ravages of the plague; neither do we make a national appeal to the good St. Ansano of Siena, the patron saint of diseases of the chest. Dare I say that by the complacency and inaction of some authorities one might be excused from thinking that their faith in miracles is even greater than that of the administrators of mediæval times? There is, I agree, every reason to expect that the mortality figure of tuberculosis will continue to fall, provided we escape another war, and even such major national catastrophes seem only to exert a temporary influence on the rate of fall of mortality from the disease. In most European countries the post-war decrease in tuberculosis mortality has been phenomenal, but mortality figures can be misleading. The number of new cases occurring every year is a surer indication of the true situation, and although the search for cases has been intense since the war, I do not think it can account for the considerable increase in new cases that is at present being recorded in so many countries.

To me, the great danger that we are facing in tuberculosis is the creation of a non-infected younger generation amidst an infectious older one. We should be warned by the rise in the incidence of the disease in the older age groups, particularly in males, and the simultaneous increase in notification of primary infection in young adults, particularly females. I would not venture to suggest that the tuberculosis problem reduces itself to the control of old men and young maidens, but I do suggest that we should be sure that every means is used to build up the resistance of susceptible age groups, so that they will not develop active disease from their first infection with virulent tubercle bacilli.

The wisdom of pursuing a policy of continually protecting persons from virulent natural infection to such a degree that a non-infected generation is established has been questioned. There is little doubt that it is right to do so, because natural infection is so haphazard and uncontrolled that we cannot be sure in any person what the result will be. To rely on natural infection to produce acquired resistance to the disease is dangerous, for the magnitude of the primary infection may be so large that it overcomes all resistance and produces active disease. This is seen only too frequently when children drink tuberculous milk or live in a tuberculous household where precautions against spread of infection are not taken. We cannot rely on such a dangerous and un-

scientific method to confer acquired resistance upon our children and young adults, therefore we must continue to protect the population from virulent infection. But we must remember that persons who are being completely protected from virulent infection have only their inherent resistance to rely upon when they eventually meet the tubercle bacillus. When this occurs they are not so well equipped to ward off infection as those who have already received and recovered from the primary infection. We know that the majority of persons in this country are infected with tubercle bacilli by the age of 30, and as it is a very rare event for an infant to be born with tuberculosis it is obvious that sooner or later every child has to face the danger of its first infection with the germ. You will quite rightly ask, Why then do we not all suffer from the disease? It is not easy to give a completely satisfactory answer, and I hope I am not begging the question when I say that it is because the dose of tubercle bacilli is usually small and can generally be overcome by the inherent resistance of the body. Increase the dose or lower the resistance and progressive disease will develop.

What happens when the body meets further infection after recovery from the primary infection depends to a very great extent on environment and living conditions. Evidence of this is found in tuberculous village settlements, where children born and living in a tuberculous community do not develop the disease. There is no doubt that many of these children are infected many times, but good living conditions keep their resistance high and prevent the development of the disease in spite of continuous reinfection. A similar freedom from the disease is noted among the staffs of well-administered sanatoria where the incidence of tuberculosis is below that found in the general population and much less than in the staffs of general hospitals. The complete opposite to this was seen in the German concentration camps, where the appalling living conditions soon reduced all resistance to the disease, and from 40 to 50 per cent. of the prisoners died of tuberculosis.

All these observations indicate that to prevent the disease we must maintain and raise the body's resistance to the highest level possible. In this respect special precautions are needed during the periods of life when resistance against tuberculosis seems to be low. These are infancy, the late teens and early twenties, and in males between 50 and 60. After the age of 30 most persons have been infected, so that further external contact with the germ becomes of less importance with regard to the development of active disease than the maintenance of resistance. This has an important bearing on the employment of tuberculous persons, and the greatest of care must be exercised in coming to decisions on this matter. It is not difficult to suggest suitable employment for tuberculous persons, but it is difficult to overcome the problems associated with the spread of infection that arise when they work with healthy people. The danger from infection is not so great a problem as is usually imagined, for it is the non-infected healthy workers that run the greatest risk of developing active disease. These are the workers that must be protected by all known means. For the other employees we need not be quite so fearful provided—and this is an all-important proviso—that they are well nourished and lead healthy lives under good conditions. If they do develop tuberculosis it will be due in the majority of cases, but not all, to an exacerba-

tion of an old lesion. There will always be a few unfortunate individuals who receive a massive infection from a careless person with dirty habits, but much can be done to prevent this by education in precautionary methods and disciplinary action.

About one thing we must always be very careful—that is, blaming an industrial process for causing tuberculosis. Just because there is a high incidence of tuberculosis in any industry, we must not jump to the conclusion that it is the industry that is the cause of the disease. In most instances the reason will be found in the workers themselves, and until a careful survey has been made of the family histories, the type of lesion discovered, the age and tuberculin sensitivity of all the employees, and the working environment of the infectious cases, no conclusion can be made. I have said that there is danger in creating an increasing number of non-infected persons in a community where there are still infectious cases. In reply to this, it is sometimes pointed out that no catastrophe has so far occurred in states such as Utah and Idaho, where the mortality rate is as low as 8 or 9 per 100,000 population. Here the chances of the non-infected meeting tuberculous infection are comparatively rare. What happens to these non-infected persons when they emigrate is not known. In West Africa it is noticeable how a more chronic type of lesion occurs in tribes that reside in areas that have been associated with white men for the last three hundred years, while in those areas where European penetration is fairly recent the disease retains its acute form. There is no simple explanation of this phenomenon, and it would be valuable if the Tuberculosis Department of the World Health Organisation would follow up the work that McDougall has begun by collecting the necessary information to correlate the type of disease found in different countries with the infection rate, the length of time the infection has been known in the country, the main features of the diet, and special characteristics of the population.

B.C.G. Vaccination

I hope you will agree with me that, in tuberculosis, to create an increasing number of non-infected individuals and to allow them to mix with infectious persons is a policy that will eventually lead to a disastrous situation. Fortunately in B.C.G. vaccination we have a means of lessening the danger of the primary infection. This vaccine is made from a harmless form of tubercle bacillus that was discovered by two Frenchmen—Calmette and Guerin. It has been used on the Continent for nearly thirty years, and up to date over 12,000,000 children and adolescents have now been vaccinated without any harmful effects. In spite of this large number, there is much that we should like to know about this method of protection against infection, but sufficient observations have been made to say that it confers a certain degree of protection against the first contact with virulent infection. I think this is generally accepted, otherwise the Ministry of Health would not have offered the vaccine to nurses, medical students and others at risk. It is, however, important that we know what degree of immunity is conferred upon those vaccinated, and research is being actively pursued in certain areas in England to elucidate this problem.

Let it not be thought, however, that vaccination is the complete answer to the problem of tuberculous infection. B.C.G. or the vole vaccine will confer a certain protection against the primary infection with virulent organisms, but the maintenance of good health must be ensured by healthy living in a good environment. No amount of vaccine will protect against massive infection or against the consequences of malnutrition, overstrain and poverty.

Sufficient has been said to show that when infection takes place it is followed by disease only if the operative forces are in a certain state of imbalance in which the promise of antibody production, and in some cases antitoxin formation, fails to be fulfilled in relation to the sensitivity of the invaded tissues. In adults who possess a high native resistance to tuberculosis the development of this state of imbalance is infrequent, and the majority of primary infections are overcome. Unfortunately it has not yet been possible to find a direct simple method of assessing this native resistance in any particular individual. In a normal person a rough indication can be obtained from the degree of local reaction to an intradermal injection of B.C.G. vaccine. The more severe the reaction, the greater the native resistance. Racially we can make an approximate assessment of resistance by the lethality rate, which is the mortality rate divided by the infection rate. According to some recent surveys, this is fairly uniform for all European countries, being 1 to 2 per cent. For coloured races it is 5 per cent. and for all children both black and white under the age of two, it is 20 per cent. These figures indicate that native resistance varies with age and race. All infants appear to be equally susceptible to tuberculosis, but in young adults there is a definite tendency for coloured races to show less resistance to the disease than whites. This question of racial resistance is full of pitfalls, and it is easy to assume that the sensitivity of the tissues to tuberculous infection as measured by the tuberculin test is an assessment of resistance. I think that a positive reaction to the test means that there are living tubercle bacilli in the body. These bacilli may, at any time, give rise to active disease. There is certainly no quantitative relation between sensitivity and immunity, as it is possible to have a considerable degree of resistance in the absence of tuberculin sensitivity. I do not think, however, that you can have tuberculin sensitivity without resistance, although the intensity of the tuberculin reaction is not a measure of that resistance.

We must realise that certain sections of the community are more susceptible to tuberculosis than others, and that these are the groups on which the full force of our protective measures should be exerted. These susceptible groups should be constantly warned of the danger that exists, and the others should be made to realise that contact with active cases of tuberculosis need hold few fears, but that anxiety, overstrain, undernourishment and the low standard of living are the potent, predisposing causes of active disease. In treatment we should be cautious when we recommend upsetting a stable equilibrium that has been naturally established between the bacillus and the defence mechanism of the body. Drastic trauma or a sudden disturbance of the metabolism may cause so serious a decrease in the resistance of the tissues to the bacilli that a rapid extension of the lesion will result. Nearly thirty years ago a great Danish physician warned us that we must guard against making our fight against tuberculosis into a fight against the tuberculous. It is well to remember

that advice both in treatment and prevention, but we shall not be able to carry it out unless our practice is based on continual observation and research, both in the laboratory and the field.

The present state of our knowledge of the epidemiology of tuberculosis does not reflect great credit on the amount of work that has been done in the past on determining the incidence of infection in particular age groups, in relation to environment and employment. With the increasing use of B.C.G. vaccine, it is now too late to try to throw light on these problems by tuberculin surveys in England and Wales. Fortunately a fairly extensive investigation has been just completed under the direction of the Medical Research Council in co-operation with the British Tuberculosis Association, and it may be still possible for further work to be done in this direction in Scotland. The information that is obtained from such surveys always produces new problems, and these can only be solved by further surveys. There is thus a temptation to follow the opinion of Lord Kelvin, who maintained that " when you can measure what you are speaking about and express it in numbers, you know something about it, but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind."

Statistics are good servants but bad masters and medicine is not an exact science, so mathematical formulæ sit uneasily alongside of information on human personalities and temperaments. Whilst therefore we should press forward our investigations to the limit that practical considerations will allow, we should not always wait for the final results before extending to needy individuals the benefits that have been indicated by the general observations of the majority of those using the particular treatment or prophylactic measure under consideration, provided that in every case laboratory evidence justifies its use and has shown that the procedure is harmless when properly administered. We are still in need of a reasonably accurate, simple method of determining the degree of activity of a tuberculous lesion. At present we can do little more than submit the patient to exercise tolerance tests and estimate the activity by the constitutional disturbance that follows. In radiography we possess an excellent means for discovering early changes that indicate tuberculosis of the lungs, but it is only by a series of X-ray examinations over a period that we can assess the activity of a lesion. Radiography is therefore very useful in diagnosis, but it is a crude method for determining the activity of the disease. There is hope that in the future it will be possible to carry out a blood test that will indicate the presence of active tuberculosis. Such a test would solve many clinical and administrative difficulties. We require research to determine the relative importance of the predisposing causes of the development of disease. For instance, we should like to know how great a part nutrition plays in rendering a person more susceptible to tuberculosis after infection has occurred. There are many similar problems awaiting solution, but perhaps the most urgent need is to obtain a clearer interpretation of the relationship between tissue sensitivity and immunity. In fact, that which we so glibly term " the defensive mechanism of the body " is for the most part an unknown procedure and holds many secrets. Before we can be sure that we are treating patients in the correct

way, and before we can solve the many etiological problems that are continually arising, it will be necessary to have further information on the pathogenesis of tuberculosis. A wide field of research has been opened up now that it is possible to study the influence of infection on living cells growing on certain media. The behaviour of these living tissue cultures, when they have been infected with virulent tubercle bacilli, under varying conditions, should throw further light on the nature of cell resistance to the invading organism.

In the long catalogue of human infirmities, tuberculosis diseases are undoubtedly the most deserving the study of the physician, whether we regard their frequency or mortality. Confined to no country, age, sex or condition of life, they destroy a larger proportion of mankind in temperate climates than all other chronic diseases taken together.

SIR JAMES CLARK: *A Treatise on Pulmonary Consumption.* London, 1835, p. 7.

Why, when one comes near consumptives, or people with ophthalmia, or the itch, does one contract this disease, while one does not contract dropsy, apoplexy, fever, or many other ills? . . . With the consumptive the reason is that the breath is bad and heavy. . . . In approaching the consumptive one breathes the pernicious air. One takes the disease because there is in this air something disease-producing.

ARISTOTLE: *Problems.*

THE RELATIONSHIP BETWEEN THE CLINICAL AND PATHOLOGICAL ASPECTS OF BRONCHIAL CARCINOMA

By M. Bariety

From the Department of Diseases of the Chest, Hôtel-Dieu, Paris
(Director, Professor M. Bariety)

During the past five years Drs. J. Delarue and J. Paillas and I have tried to correlate the histological characteristics of bronchial carcinoma with the clinical course, anatomical developments and bronchoscopic appearances. The problem is not a new one, and Rist and Rolland in 1930 emphasised the impossibility of relating these factors. Huguenin also shared this view until recently. Gebauer, Muller and Miller, Hollingsworth, Adams and Graham have held that it is possible to attribute to each histological form its own characteristics.

The present study covers 100 selected patients observed from the onset of the disease with repeated bronchoscopic examinations and ultimate confirmation by examination of either surgical or post-mortem material.

Three histological varieties are commonly recognised:

(1) epidermoid (squamous-cell) carcinoma;
(2) small-cell or oat-cell (anaplastic) carcinoma;
(3) cylindro-cubic cell (adeno-) carcinoma;

and we shall discuss these in turn.

(1) Epidermoid Carcinomas

These comprise 48 of our own cases. In addition 10 specimens presented by Maurer, Mathey and Renaut are included in the macroscopic description.

Incidence.—This is the most common form of bronchial carcinoma, representing 48 per cent. of our cases. Since this figure is comparable with that quoted by other workers, it is fair to regard epidermoid cancers as comprising half of all the primary bronchial carcinomas.

Sex.—As with most bronchial carcinomas, the epidermoid variety occurs much more frequently in men than in women: in our series the ratio was 47 men to 1 woman.

Age.—The average age of our patients was 54 years 4 months, the youngest being 30 and the oldest 80. The prevalence of epidermoid carcinoma in the fifth and sixth decades of life is shown by the following table:

4th	decade	..	..	..	..	1 case
5th	„	..	..	..	..	20 cases
6th	„	..	..	..	..	14 „
7th	„	..	..	..	..	10 „
8th	„	..	..	..	..	3 „

Location.—28 of our cases were right-sided, distributed as follows:

Upper lobe bronchus	10
Middle „ „	2
Lower „ „	16

20 left-sided cases were distributed as follows:

Upper lobe bronchus	7
Lingula	2
Lower lobe bronchus	11

Macroscopic Study.—Preliminary observations. Twelve specimens, obtained by surgical resection, could be classified in three groups, viz:

(i) Endobronchial growths (8 cases). Sometimes the growth occurs as a single, bulky nodular mass; at other times several nodules occur close together in a limited area of the bronchial mucosa; on yet other occasions there is a fungating tumour which has a narrow attachment area and projects up the lumen.

The tumour in these cases appears macroscopically to involve only the lumen and wall, without extension into the peribronchial tissues. This is confirmed histologically in serial transverse sections. Lymph nodes are free of tumour.

(ii) Limited peribronchial growth and endobronchial nodules (3 cases). Around the involved bronchus is either a short cord of growth or a small, circumscribed, compact white tumour.

(iii) Constriction of bronchus by peribronchial growth with fine mucosal nodularity distal to this segment. We have observed only one of these rare cases in which the bronchus is ensheathed in neoplastic tissue several centimetres thick and yet has an undamaged mucosa.

Bronchoscopic Study—Endoscopic examination at this stage conforms with these pathological findings in surgical specimens. The only manifestation is mucosal nodularity. We have never found extrinsic compression without a lesion of the mucosa. In some cases nodules and extrinsic compression (especially of the posterior surface of the bronchi) have been found together at the same level. The size of the mucosal nodules is variable, but they may be large and block the bronchial lumen.

Their appearances are as follows: clean, bubbly-looking, well-defined, high, sometimes semi-transparent nodules which do not bleed (15·7 per cent.); red nodules that bleed as soon as the bronchoscope reaches the region of the tumour and in which the examination is complicated by local hæmorrhage (19 per cent.); irregular, shagreened mucosa which is prone to bleed (12·2 per cent.); stenosis of the bronchus, the mucosa remaining smooth, but the sides approximating to form a conical blind alley (this stenosis is not due to extrinsic compression, but to mucosal thickening); pearly-white nodules are less common.

Two facts stand out as bronchoscopically characteristic of epidermoid carcinoma. First, the absence of pure extrinsic compression and the relative scarcity of extrinsic compression associated with mucosal nodulation. Second, the frequency with which these lesions are prone to bleed (35 per cent. of epidermoid carcinomas have hæmorrhagic nodules or mucous changes).

Spread of the Neoplastic Process.—Growth of epidermoid carcinoma is very slow, its extension being outwards into the lung parenchyma and sometimes intra-

bronchial. Upward peribronchial spread is slow, and generally the mucosal nodules are situated higher than the upper limit of the peribronchial growth; occasionally they are at the same level. Only once have we found peribronchial extension ahead of mucosal tumour nodules. The growth encroaches extensively upon the lung parenchyma and we shall study in detail its appearances in this connection. The inter-tracheo-bronchial nodes are, on the other hand, seldom affected.

Necropsy Findings.—Sections of material obtained post mortem show quasi-pathognomonic features of epidermoid carcinoma, and these were apparent in almost all our cases. Epidermoid carcinoma shows characteristically large tumour masses extending mainly into the lung parenchyma. Its outline is poorly defined till it reaches the pleura. Lack of homogeneity on cut surfaces is a most significant feature. When it occupies a whole lobe the greyish-white matter of which it is composed can be recognised at the periphery. In the centre is a wide vomica with shaggy walls, transversed by nodules and by large vessels that may be free within the cavity. Cavitation seems to involve both tumour tissue and lung parenchyma. In fact, the whole area is greyish and granular, and it is difficult to separate cancerous from non-cancerous tissue; often what appears to the naked eye to be merely inflammatory tissue proves histologically to be tumour.

Epidermoid carcinoma frequently extends to the mediastinal pleura and the pericardium. It is noteworthy that even when the tumour reaches the tracheal bifurcation the broncho-tracheal nodes are seldom involved. The growth tends to protrude beyond, leaving the tracheal spur salient and undistorted.

Clinical Study.—The first manifestation of the disease in 16 cases was an acute respiratory infection, diagnosed as pneumonia, and in 14 others general debility. It is noteworthy that the disease was discovered in three of our patients during routine roentgenological examination. In half the cases cough was the main symptom: hæmoptysis was less common.

The subsequent development varies as follows: it can become chronic and afebrile (16 cases); the condition may appear to be one of pulmonary suppuration (10 cases); at other times the main symptoms are cough (22 cases) and hæmoptysis which occurs more frequently as the disease progresses (21 cases). Finally, it should be noted that 18 of our patients had chronic bronchitis.

Radiological Study.—The radiological appearances at onset were:

Segmental opacities	36 cases
Nodular pictures	6 „
Round homogeneous opacities ..	3 „
Pictures of an abscess not surrounded by any opacity	2 „
Pleural effusion	1 case

In four cases a cavity appeared in the middle of the segmental opacity.

Course of the Disease.—The slow development of epidermoid cancers constitutes their outstanding feature. The length of the disease—*i.e.*, from onset to fatal termination—averaged 19 months, and histological diagnosis was made 7½ months after clinical onset, although it is possible that the cancer may have been developing for some time before the appearance of symptoms.

Therapeutic Study.—In the early stages epidermoid carcinomas are favourable to surgery. Inoperable cancers subjected to radiotherapy, even in association

with penicillin and atropin, invariably became worse, probably as a result of the frequent infection of the tumour. Surgical resection is accordingly the treatment of choice, and, in fact, such tumours, when limited to an endobronchial nodule with any lymphatic nodes, are easy to eradicate. The whole problem lies in early diagnosis, which is often more difficult owing to the way in which the tumour itself lies hidden.

(2) Small-cell Carcinomas

Incidence.—In our series small-cell cancers represent 14 per cent of primary bronchial growths.

Sex.—The ratio of men to women affected was 13:1.

Age.—Small-cell carcinomas attack relatively young subjects, the average age of our patients being 47 years (range 33 to 59 years).

Location.—The distribution was as follows:

Right side: 11 cases

Upper lobe bronchus	3 cases
Middle „ „	2 „
Lower „ „	3 „
Lower lobe spical bronchus	3 „

Left side: 3 cases

Upper lobe bronchus	1 case
Lingula „ „	1 „
Lower „ „	1 „

It is convenient to distinguish, anatomically and clinically, two main groups of small-cell cancers:

(*a*) Those spreading inside the mediastinum and coming apparently from the upper lobe bronchi, and
(*b*) Carcinomas situated anywhere else, including those of large bronchi.

(*a*) *Small-cell Carcinomas spreading inside the Mediastinum*

These tumours, situated principally in the mediastinum, involve the pulmonary parenchyma relatively slowly.

Incidence.—They represent 4 per cent. of all primary bronchial carcinomas and 28 per cent of the small-cell variety in our series.

Sex.—All our patients were men.

Age.—The average age was 44 years (range 35 to 51 years).

Location.—In our 4 cases 3 tumours were on the right side and one on the left, at the junction of the upper lobe bronchus and the main bronchus.

Macroscopic Study.—The tumour arises at the first division of the main bronchus.

Bronchoscopic Aspect.—An early bronchoscopy usually reveals extrinsic compression. The upper lobe bronchus looks strangulated, but its mucosa retains its normal appearance. Some nodules can be seen in association with this stricture, and they are mostly distinct, vesicular, pale, translucent and not hæmorrhagic. They are seen sometimes on the bronchial wall above and

sometimes low down on the stenosed area. In some cases the nodule appears on the spur of the upper lobe bronchus, which is enlarged and distorted, while the tracheal spur remains normal. Soon small pinkish nodules appear in the mucosa of the main bronchus, and these seem to be the first stage in the growth of the nodules to that level.

Extension of the Cancerous Process.—Beginning thus around the main bronchus, the tumour spreads rapidly to form an enormous inter-tracheo-bronchial and mediastinal mass. The neoplastic process first spreads along the originally affected bronchus, along all its ramifications towards the trachea, the lower lobe and the opposite main bronchus. Simultaneously with this peribronchial progression there is endobronchial extension. Bronchoscopic examination at the later stages of the disease will show, in addition to voluminous mucosal nodules over the walls of the bronchi (the tracheal spur being no longer recognisable), an extrinsic compression at the lower end of the trachea. Such carcinomas reach the lymphatic nodes rapidly, attacking first the interbronchial and then the inter-tracheo-bronchial nodes. Involvement of the latter produces displacement of the tracheal spur. The large pulmonary vessels and the organs crossing the mediastinum are often surrounded by the tumour. Visceral metastases are frequent and seem to occur early in the disease.

Later Stages.—The mediastino-pulmonary tumour is now found as a homogeneous block, often in the form of a voluminous tumour situated in the inter-tracheo-bronchial region around the bronchus and the trachea. When cut, the mass is whitish with little or no excavation. Its texture is homogeneous. It is well defined from the lung parenchyma, at least macroscopically. The tumour always extends farther up or down than the endobronchial nodules.

Clinical Study.—The onset of the disease is characterised by two main symptoms, pain and dyspnœa. Gradually these symptoms became more pronounced until the increasing effects of compression may be manifested by pain, dyspnœa, cyanosis, œdema of the chest, dysphagia or laryngeal paralysis. On the whole, cough and hæmoptysis are rare. The general condition of the patient may remain good for a long time and there may be little or no fever. Signs of mediastinal compression appear some time after the initial cough and pain.

Radiological Study.—The mediastino-pulmonary type of small-cell carcinoma is the only one which shows an almost uniform roentgenological picture. At the clinical onset of the disease, radiographs show an ovoid, polycyclical and homogeneous opacity projected upon the tracheal bifurcation which is embedded in it. In some cases it has branch-like outlines.

There soon appears evidence of parenchymatous involvement—viz., a diffuse, homogeneous, progressively increasing opacity of the upper lobe. In the middle of this opacity the outline of the actual growth may still be visible. It gradually increases in size, but remains well defined. In the final stages complete opacity of the whole of the chest on one side can be seen.

Course of the Disease.—The evolution of these tumours is progressive with but few short periods of quiescence. Unlike other forms of bronchial cancer, spasmodic development is not very pronounced.

The duration of the disease is short, death occurring on an average 9 months after the appearance of the first symptom (range 4 to 12 months). It usually

follows a period of asphyxia or rapidly increasing cachexia. In our series the diagnosis was made on an average $3\frac{1}{2}$ months after the first symptom.

Treatment.—Obviously surgery is of no value in such cases, but they are sensitive to radiotherapy.

(b) Alternative Distribution of Small-cell Carcinomas

Most observers have insisted on the frequency with which small-cell cancers take the form of mediastino-pulmonary tumours. Usually they fail to recognise, or undervalue, their frequency in other sites and hence their anatomo-clinical characters. In contrast to the mediastino-pulmonary forms, these tumours involve the pulmonary parenchyma at an early stage.

Incidence.—They represent 71 per cent. of the small-cell growths and 10 per cent. of all primary bronchial carcinomas.

Sex.—In our series 9 occurred in men and 1 in a woman.

Age.—The average age was 48 (range 43 to 59).

Distribution.—Eight of the tumours were right-sided, two left-sided:

Right side:	Middle lobe bronchus	2
	Lower „ „	3
	Upper „ „	3
Left side:	Lingula	1
	Lower lobe bronchus	1

Macroscopic Study.—The bronchial wall is surrounded by a tumour which quickly invades the peribronchial spaces. In the early stage the neoplastic mass is well limited and, at least macroscopically, does not encroach extensively upon the lung.

Bronchoscopic Study.—The parietal tumour is accompanied at an early stage by an endobronchial nodule. This is easily recognised in the main bronchi or in the lower lobe bronchi. Generally it is single and has appearances similar to those of the endobronchial nodules in the other small-cell growths already described. When an early endoscopy is made this nodule appears as a well-defined protrusion with straight edges, while the mucosa and the wall around retain a normal appearance.

Extension of the Cancerous Process.—The neoplasm spreads mainly around the bronchus. On the whole it tends to remain small in size, and seldom resembles the mediastino-pulmonary type of tumour. Macroscopically the mass is well defined and shows little or no cavitation.

Extension around the Bronchi.—The peribronchial tumour progresses mainly upwards, the lower lobe bronchi being seldom involved. Soon it reaches the point of origin of the lower lobe bronchus from the main bronchus. Peribronchial extension is well in advance of endobronchial nodularity, but the patient often dies before the tumour reaches the tracheal bifurcation.

Extension inside the Bronchi.—Bronchoscopic examination at the stage at which the tumour already includes the upper parts of the bronchial tree reveals, especially in the main bronchus, a stenosis due to one or several nodules. Just above this the bronchial lumen may show narrowing due to extrinsic compression.

Later on the whole main bronchus, the tracheal bifurcation, the commencement of the opposite main bronchus and the termination of the trachea may

be covered with these mucosal nodules. At this stage the lower end of the trachea suffers extrinsic compression, just as in the advanced mediastino-pulmonary type of small-cell carcinoma.

Extension to the Lymphatic Nodes.—Involvement of the nodes is very rapid. The interbronchial group is undoubtedly the first to be affected and soon becomes an integral part of the tumour mass, from which it can be distinguished on section only by its darkish colour. Extension towards the bronchial nodes is slower.

Connections with the Mediastinum.—These cancers seldom grow sufficiently extensively into the mediastinum to produce compression of the main organs that cross it. In the final stages even, when the tumour may come into contact with the mediastinum, it seldom produces manifestations comparable with those seen in the mediastino-pulmonary form.

Extension towards the Pulmonary Vessels.—This is often very striking. Neoplastic cells are frequently seen in the vessel walls and cancerous lymphangitis is common. In one of our cases vascular ulceration induced a fatal hæmoptysis.

Metastasis.—This is frequent and rapid, either to the lymphatic nodes or the viscera.

We were able to recognise a special form of small-cell carcinoma forming a well defined voluminous mass that grew quickly within the lung and exactly occupied the apical segment of the lower lobe.

Clinical Study.—If the mediastinal-invading tumours develop with distinctive features the other small-cell cancers assume a polymorphism comparable with that of other histological forms. Early endobronchial and pulmonary involvement is characteristic. The clinical symptoms are not specially distinctive: cough is frequent and hæmoptysis relatively uncommon; pain and dyspnœa are frequent, but less intense than in other varieties.

Radiological Study.—There is no radiological feature peculiar to this form of cancer. In our series we invariably found segmental opacities which developed rapidly, becoming first lobar in distribution, and finally involving the whole of one side of the chest.

Course of the Disease.—These cancers develop by successive exacerbations with intermittent periods of apparent remission. They constitute a very severe form of bronchial tumour, death occurring on an average twelve months after the first symptoms. In our cases diagnosis was usually made five months after the first appearance of symptoms.

Therapeutic Study.—These cancers are, after the mediastinal forms, the least amenable to radical surgery, owing to their rapid progression and early metastasis. They are, on the other hand, often suitable for radiotherapy, to which 5 of our patients were submitted. In 4 cases there was complete disappearance of the endobronchial lesion, but unfortunately all our patients died, within a period varying from a few months to one year, from local recurrence or cerebral metastasis.

Conclusion.—The small-cell cancers appear at a relatively young age. They exhibit two anatomico-clinical forms, one of a mediastino-pulmonary tumour, the other a bronchial tumour.

In all cases the macroscopic features are those of a well-defined, homogeneous, non-cavitating and often large mass. Spread to the lymphatic nodes and

other metastases are common and very rapid and in fact, characteristic of this condition.

(3) Adeno-carcinomas

Well differentiated adeno-carcinomas appear to us too rare to justify space in the present article. We shall deal only with the poorly differentiated glandular cancers, although it is no easy matter to find in this group very clearly defined anatomico-clinical characteristics.

Our observations are based on 28 cases, of whom 22 were men and 6 women and of whom the average age was 55½ years. This type of carcinoma represents 28 per cent. of all bronchial growths in our series.

There are two main groups: (*a*) those developing as mediastino-pulmonary growths, and (*b*) those which show little mediastinal involvement.

(*a*) *Cancers growing towards the Mediastinum.*—Seven such cases came under our care, of which 6 were male, and the average age was 50. Anatomically, clinically and radiologically they were identical with the small-cell mediastino-pulmonary tumours, with similar short history and fatal termination 4½ months after the appearance of symptoms.

(*b*) *Carcinoma showing Little Mediastinal Involvement.*—Of 21 cases, 16 were males and 5 were females and the average age was 57.

Ten cases were right-sided as follows:

Right main bronchus	2
Upper lobe „	2
Middle „ „	1
Lower „ „	5

The 11 left-sided cases were distributed as follows:

Left main bronchus	5
Upper lobe „	2
Lingula	2
Lower lobe bronchus	2

In general these growths seem to resemble the non-mediastinal small-cell carcinomas. The macroscopic specimens often show large, well-defined, somewhat homogeneous whitish tumours. It is possible that this type of growth may have a predilection for the small bronchi. In 5 of our cases the radiograph showed a large rounded opacity, the main bronchi being apparently unaffected. It was only at a much later stage that we were able to demonstrate by bronchoscopy the presence of nodules in that part of the bronchial wall in contact with the tumour.

Unlike those of the small-cell carcinomas, the mucosal nodules showed a tendency to bleed during bronchoscopy (16·6 per cent. of the mucosal lesions were hæmorrhagic). Extrinsic compression is not as frequent as in the small-cell cancers (16·6 per cent., compared with 52·8 per cent.).

From the clinical point of view it is extremely difficult to differentiate these tumours from the small-cell ones. In both groups the main symptoms and the course of the disease are identical. In our series the diagnosis was made on an average 4 months after the appearance of symptoms, and the average length of survival was 8½ months. These cancers are radio-sensitive with good immediate but poor end results.

Conclusion.—One is tempted to include in a single group the small-cell carcinomas and the poorly differentiated adeno-carcinomas, because histologically they are akin, some parts of the small-cell variety having a suggestive adeno-carcinomatous appearance while in some adeno-carcinomas there are anaplastic areas of small-cell growth. Histological classification into either the small-cell or adeno-carcinoma group depends simply on the predominant type of growth. With regard to gross structure, clinical course and therapeutic response, the two tumour groups are also very similar. We agree with Graham's assertion that it is almost impossible to separate small-cell carcinomas from poorly differentiated adeno-carcinomas.

General Conclusions

(1) There is a definite correlation between the histological structure of bronchial carcinomas and their macroscopic appearance, course and amenability to treatment.

In a few instances (tumours involving mainly the mediastinum) there is no correlation between histological type and symptomatology nor radiographic appearance.

(2) The most importamt facts which emerge from this study are those concerning the relative amenability of the different histological types of bronchial carcinoma to therapy. The slow progress of epidermoid carcinomas means that they are eminently suitable for surgical resection when diagnosed early. Poorly differentiated and anaplastic carcinomas (small-cell carcinomas and atypical adeno-carcinomas) progress rapidly. They can seldom be treated successfully by surgery and must be submitted to radiotherapy.

BIBLIOGRAPHY

Adams, R. (1946): *J. Amer. Med. Ass.*, **130,** 547.
— (1948): *J. Thorac. Surg.*, **17,** 306.
— (1948): *Amer. Rev. Tuberc.*, **4,** 353.
Bariety, M., and Paillas, J. (1947): *J. Franç. méd. et chir. thorac.*, **1,** 356.
—, Delarue, J., and Paillas, J. (1948): *Bull. et Mém. Soc. Paris*, **64,** 186.
—, — — (1948): *Presse Méd.*, **64,** 19, 238.
— and Paillas, J. (1948): *Bull. et Mém. Soc. Méd. Paris*, **65,** 32, 1100.
— Delarue, J., and Paillas, J. (1949): *ibid.*, 23, 920.
—, — — (1949): *ibid.*, 23, 925.
—, — — (1950): *J. Franç. méd. et chir. thorac.*, **4,** 169.
Gebauer, P. W. (1941): *J. Thorac. Surg.*, **10,** 373.
Graham, E. A. (1949): *Surg. Gynec. Obstet.*, **88,** 129.
Hollingsworth, R. K. (1947): *Ann. intern. Med.*, **26,** 377.
Huguenin, R. (1928): " Cancer primitif poumon," Thèse, Paris.
— and Fauvet, J. (1949): *J. Franç .méd. et chir. thorac.*, **3,** 60.
Muller, G. P., and Miller, B. S. (1945): " Primary carcinoma of the bronchus: Its pathology, symptomatology, diagnosis and treatment," *Clin.*, **4,** 42.
Poulet, J. (1950): " Les épithéliomas épidermoïdes des bronches," Thèse, Paris.
Renaud, C. (1948): " Le cancer bronchique à petites cellule," Thèse, Paris.
Rist, E., and Rolland, J. (1930): *Ann. Méd.*, 1930, 231.

ENDO-BRONCHIAL TUBERCULOSIS

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The subject of endo-bronchial tuberculosis as we understand it at present is of comparatively recent origin, and our understanding of its rôle in the causation of symptoms and as a factor in the pathogenesis of certain complications of pulmonary disease more recent still. Until a short while ago, the following statement of Stokes (1837), which he made in his " Diseases of the Chest," had a modern ring: " I shall not occupy many pages on this subject [ulceration of the bronchial tubes], which is of more interest to the pathological anatomist than to the student of diagnosis. As yet, indeed, we are ignorant of any symptom or sign which may be considered pathognomonic of the lesion in its simple form, where the process has commenced in and is confined to the mucous surface of the tube, and even in those more complicated cases of ulceration and perforation into the lung we recognise the occurrence of bronchial ulceration by phenomena resulting from other mechanical conditions which have resulted from the primary disease."

The earliest descriptions of lesions of the bronchi occurring in phthisis would appear to be those of the great English physician, the originator of the term " phthisiology," Richard Morton (1694), who described the process of ulceration of broncholiths into the bronchial tree in his work " Phthisiologia." Morgagni (1761), some fifty years later, is credited with having described bronchial ulceration, but I have been unable to trace this.

The first accurate description is ascribed to M. Cayol (1810), who wrote a thesis on this subject to which Laennec (1829) refers in complimentary terms in his " Mediate Auscultation and Diseases of the Chest," where several pages are devoted to bronchial ulceration. He describes the ulcers, which he thought were rare, as being a dirty greyish colour, covered with puriform mucus, with edges somewhat swollen and marked by redness, which extends to some distance around. He hardly admits as ulcers those cases where bronchial glands perforate into the lumen. He notes a tendency to stenosis of the latter by virtue of cicatrisation. He describes the wheeze and rhonchi as characteristic manifestations, and notes the rapid downward course of patients with bronchial tuberculosis.

Louis (1825) described the bronchial appearances in the neighbourhood of cavities, and gave excellent descriptions of tuberculosis of the larynx, epiglottis and trachea. Later, he gave a statistical analysis of the incidence in 102 cases; in these he found only seven cases with bronchial disease, but admits that had the bronchi been examined more carefully it is probable that a greater incidence would have been revealed.

In Vienna in the middle of the nineteenth century Rokitansky (1842), in his famous textbook on pathology, gave a good description of the appearances of the diseased respiratory passages and related endo-bronchial ulceration to cavitation.

Heinze (1879) analysed 1,226 cases, and found 8 per cent. with tracheal lesions, but the bronchi were not studied, and Eppinger (1880) recognised a type of miliary laryngeal and tracheal tuberculosis which exists without pulmonary cavitation.

The condition appears to have passed into considerable neglect, both from the academic and practical points of view, until 1924, when Heaf published a paper based on a study of 133 autopsies at Colindale, 44 per cent. of which showed lesions in the trachea—again the bronchi are not mentioned. He described the lesions and drew attention to the clinical picture of tracheal tubercle, dyspnœa, paroxysmal cough without sputum, and soreness of the upper chest after coughing.

Our real interest in the subject in modern times may be said to date from the now classical papers of Eloesser (1931, 1932, 1934), on bronchial stenosis and its results. By 1937 American literature was reporting the appearances and clinical effects of tuberculosis on the trachea and bronchi in terms which are still regarded as fundamental at the present day. Thus, in 1934, Reichle and Frost discussed the condition from the point of view of pathogenesis; then papers were published by Samson (1936), Barnwell *et alia* (1937); and finally, in 1939, a third of an issue of the *American Review of Tuberculosis* is devoted to the subject—McIndoe and his co-workers (1939), reporting on bronchoscopic findings in 272 patients, and Flance and Wheeler (1939) on autopsies of 285 cases.

The earliest writing on endo-bronchial disease in the British literature is an article by Morlock and Hudson (1939), who advocate bronchoscopy in pulmonary tuberculosis and suggest that there are five groups of cases where it is of value: (1) sputum-negative cases, (2) cases where there are areas of collapse, (3) cases where there are areas of obstructive emphysema, (4) those cases with symptoms suggestive of tracheo-bronchial tuberculosis, and (5) those cases in which other pulmonary diseases are associated with pulmonary tuberculosis.

Endo-bronchial Tuberculosis and Etiology

The condition of endo-bronchial tuberculosis is one in which there is active tuberculous disease of the trachea or bronchi, and there are certain signs and symptoms which are suggestive of this condition. Bronchoscopy is confirmatory in a large number of cases, but it must be borne in mind that the trachea and main bronchi and primary divisions of the various lobes only can be seen on bronchoscopy, and there are without doubt many cases of endo-bronchial tuberculosis where the bronchoscopic findings are normal. At one period it was thought to be unwise to bronchoscope a tuberculous patient, but in the light of subsequent experience no untoward effects appear to result from this procedure unless the patient is suffering from tuberculous laryngitis, when it is undesirable because of the local trauma to the larynx. The bronchoscopic findings in endo-bronchial tuberculosis vary considerably according to the type and extent of the disease. The earliest signs are reddening of the mucous membrane, which is localised to a small area not infrequently opposite one of the main bronchi. There may be localised, discrete tubercles on the bronchial walls, but it is important to distinguish these from small specks of sputum. This can be done by sucking out the bronchus, when the

sputum disappears but the tubercles remain, since they are sub-mucosal (Fig. 1). The small, discrete tubercles can often be seen more easily without the telescope, when a rough, granulated appearance is visible to the naked eye. A further stage in the disease is the occurrence of shallow ulcers, involving the mucous membrane only, which may progress, if untreated, to deep ulcers, involving the mucous membrane and the bronchial wall. A deep ulcer at times arises from a suppurating mediastinal gland, which occasionally ruptures into the bronchus or the trachea. Tuberculous granulation tissue arising as a tumour-like process into the lumen of the main bronchus may also be seen, looking very much like a bronchial neoplasm, and lastly bronchial stenosis, which remains after healing of endo-bronchial tuberculosis has occurred, in cases where the deep layers of the bronchi or trachea have been involved by active disease. The extent of the endo-bronchial tuberculosis can be very marked, involving a considerable portion of the trachea as well as the main bronchi. None of these findings can be seen radiologically, but radiological evidence of collapse in a segment or a lobe of the lungs, in a tuberculous patient, suggests the presence of a bronchial block which may be due to tuberculous granulation tissue, stenosis with subsequent blocking of the narrowed bronchus by sputum, or œdema of the inflamed mucous membrane. It is, therefore, important to recognise the possibility of this condition and to bronchoscope patients. Bronchoscopy will also elucidate the cause of collapse if this should be due to conditions other than endo-bronchial tuberculosis.

When endo-bronchial tuberculosis was first discussed in this country, it was generally felt that the results published from America suggested that the disease was more prevalent there than here, but this was largely due to the fact that not many tuberculous patients, at that time, were being bronchoscoped in this country, and as more bronchoscopies are performed in cases of pulmonary tuberculosis, it is clear that this is a very common complication of a tuberculous lesion of the lungs. The disease responds well to streptomycin in most cases, but the bronchoscopic findings are of importance, as one can often predict the course that the disease will take; that is to say, in cases where there is just reddening, where tubercles are present or there is superficial ulceration, even if this latter is fairly extensive, the results are good, without any undue cicatrisation; but, on the other hand, in cases where there is a deep, penetrating ulcer, or where the tuberculous granulation tissue becomes heaped up, this is frequently followed by marked fibrosis and subsequent stenosis of the bronchus concerned.

Endo-bronchial tuberculosis is not a separate disease but an integral part of pulmonary tuberculosis, and it is probable that the bronchi close to a cavity or tuberculous process are frequently, if not always, diseased, but the larger bronchi and trachea are much less frequently involved. These can be seen bronchoscopically, but the presence of endo-bronchial tuberculosis in the smaller bronchi, which are not visible bronchoscopically, can be seen at post-mortem, or in parts of lungs resected, or again by the rapid alteration in the size of a tension cavity as a result of treatment which opens up the bronchus. When the tracheo-bronchial lesion is marked, and especially when the disease occurs in the main bronchi or trachea, its presence becomes a vital influence on the treatment and prognosis of the case.

The frequency of the disease in the major bronchi appears to differ somewhat in America and in this country. This is probably due to various factors such as the type of case admitted to the sanatoria and the criterion upon which the bronchoscopic diagnosis is made. The variation in the figures given by the different authors can be judged by the published results of Flance and Wheeler (1939) and Heaf (1924). The former found macroscopic evidence of endo-bronchial tuberculosis in 3 per cent. in a series of 285 consecutive autopsies, whereas Heaf found macroscopical evidence of endo-bronchial tuberculosis in 44 per cent. in a series of 133 consecutive autopsies. This wide variation is also seen in the bronchoscopic results, where McIndoe and others (1939) found 11 per cent. positive findings in 272 cases of unselected admissions to a sanatorium, while Judd (1947) found 37 per cent. positive findings out of 500 unselected tuberculous patients.

The etiology has frequently been discussed, but it is generally thought that there are five sources of infection of the bronchi:

1. Extension from the lungs by direct infiltration.
2. Implantation of organisms from infected sputum.
3. Hæmatogenous infection.
4. Lymphatic spread.
5. As part of the primary infection.

It is probable that several of these factors are present at the same time. Histological evidence suggests that the bronchi in the immediate neighbourhood of the lungs are involved, probably by direct spread. The implantation of organisms from the infected sputum is often shown by the presence of endo-bronchial disease on the wall of the main bronchus opposite the opening of the lobe in which the disease is situated, and in addition it is known that a tuberculous laryngitis is caused by infected sputum going over the larynx and the consequent implantation of tubercle bacilli. Hæmatogenous infection, although suggested as one of the etiological factors, is rarely if ever the cause, for if there is a bacillæmia, the tubercle bacilli are much more likely to be caught up in the pulmonary tissue or the systemic circulation than in the bronchial arteries. Lymphatic spread does appear to occur, and histologically there is evidence of peri-bronchial infection of the lymphatics, which although difficult to prove is quite clearly a possible etiological factor. Finally, there is no doubt that in certain cases of primary tuberculosis, where there are enlarged mediastinal glands, occasionally one of the glands lying close to the bronchial wall, or to the trachea itself, ulcerates through into the trachea or bronchus by reason of pressure, giving rise to a large, deep endo-bronchial ulcer.

Clinical features are present only when there is disease of the larger bronchi, producing a partial or complete block of the bronchus. This is shown by the presence of wheezing, localised to the affected area. Evidence of weak air entry to one portion of the lung suggests a partial block with some localised emphysema. Radiologically there may be indirect evidence of endo-bronchial tuberculosis. This is shown as a partial or complete bronchial block, such as lobar or segmental collapse, a " black lobe " in an artificial pneumothorax,

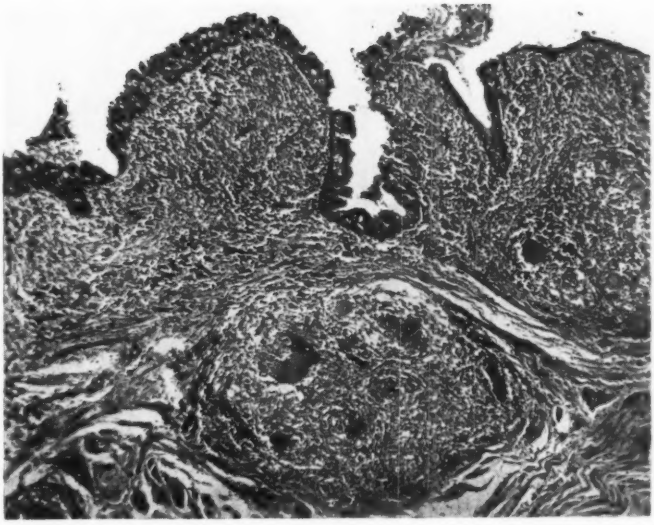


FIG. 1.—MICRO-PHOTOGRAPH SHOWING SUB-MUCOSAL TUBERCLES.

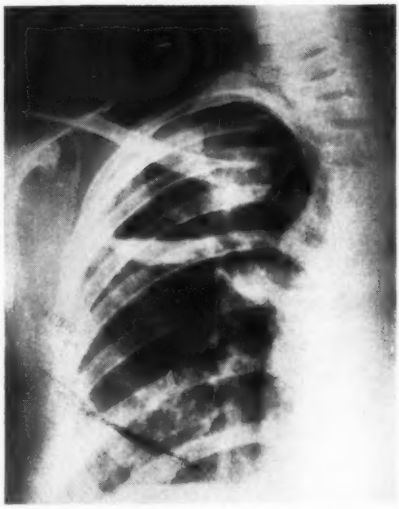


FIG. 2.—SHOWING LARGE TENSION CAVITY AT RIGHT APEX.

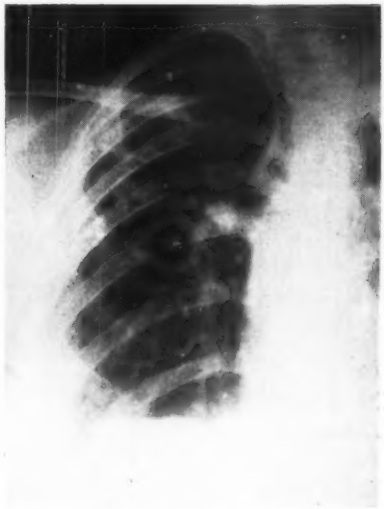


FIG. 3.—SAME PATIENT SIX WEEKS LATER, FOLLOWING TREATMENT WITH STREPTOMYCIN AND P.A.S.

To face p. 64

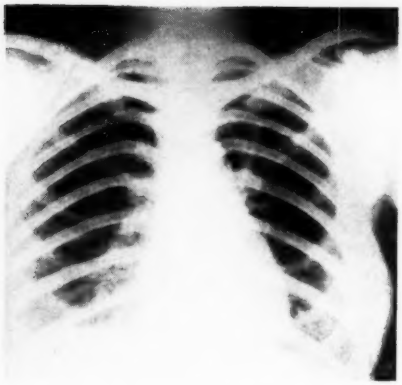


FIG. 4.—SHOWING SLIGHT, CALCIFIED LESION LEFT APEX.

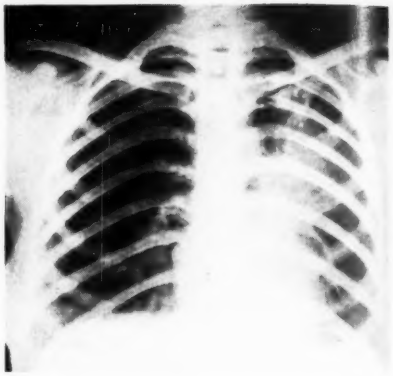


FIG. 5.—FOUR MONTHS LATER, SHOWING COLLAPSE DEVELOPING L.U.L. DUE TO STENOSIS OF THE BRONCHUS RESULTING FROM HEALING OF ENDO-BRONCHIAL DISEASE.

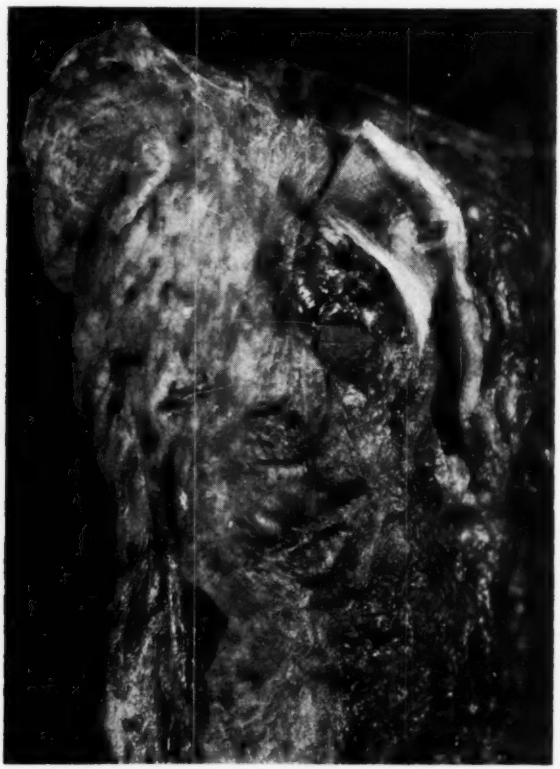


FIG. 6.—PNEUMONECTOMY SPECIMEN, SHOWING RIGHT MAIN BRONCHUS WITH ALMOST COMPLETE STENOSIS OF R.U.L. BRONCHUS.

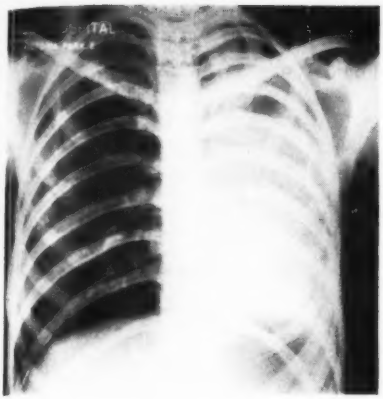


FIG. 7.—COLLAPSED LEFT LUNG, WITH SECONDARY INFECTION BEYOND STENOSED LEFT MAIN BRONCHUS.

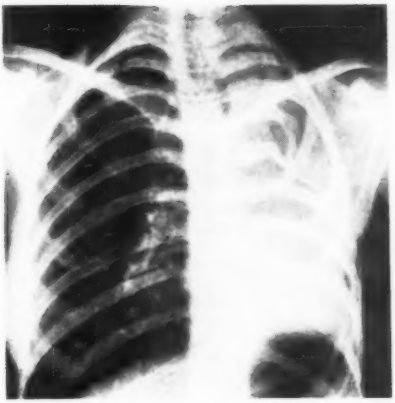


FIG. 8.—TWO YEARS LATER, AFTER LEFT EXTRA-PLEURAL PNEUMONECTOMY.

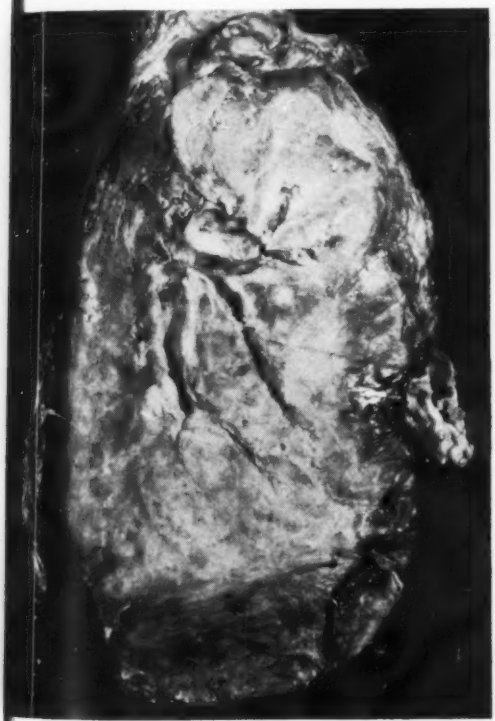


FIG. 9.—EXTRA-PLEURAL PNEUMONECTOMY SPECIMEN. BRONCHUS OCCLUDED BY TUBERCULOUS GRANULATION, WITH SECONDARY INFECTION IN LUNG.

FIG. 10.—LOBECTOMY SPECIMEN, SHOWING BRONCHIECTASIS AND ABSCESS DISTAL TO STENOSIS, AND ADJACENT T.B. GLAND.

or a tension cavity. Finally, a positive sputum, with no evidence of active pulmonary tuberculosis, is always suggestive of endo-bronchial tuberculosis.

The Effects of Endo-bronchial Disease on the Pulmonary Lesion

Endo-bronchial tuberculosis may have no effect on the pulmonary lesion if the bronchus affected is not narrowed, but when partial obstruction to a bronchus is present a tension cavity may result, since inspiration is stronger than expiration in normal breathing, being an active movement brought about by the contraction of various muscles of the chest wall and diaphragm, while expiration, on the other hand, is normally a passive movement brought about by the relaxation of these muscles and the contraction of the elastic tissue in the lungs. Under these conditions air is forced past the partial obstruction during inspiration, but is not expired so easily, and, therefore, the cavity enlarges. When these large tension cavities were first noticed there was much speculation as to the mechanism causing them, and it was soon appreciated that there was probably a valve-like action in the bronchus. Many ingenious suggestions, such as a kinked bronchus, a bronchus flattened out by the wall of the cavity, and so on, were put forward, but in view of our present knowledge of endo-bronchial tuberculosis it is probable that the above is usually the cause of this valve-like action. This is further supported by the fact that frequently large tension cavities disappear rapidly following treatment with streptomycin and P.A.S. (Figs. 2 and 3). Finally, if the endo-bronchial disease is sufficient to cause bronchial obstruction, then there will be clinical or radiological evidence of collapse of a segment or lobe of the lung, or, in the case of a pneumothorax, a "black lobe." The effect of a partial or complete obstruction on one of the main bronchi makes collapse therapy by means of an artificial pneumothorax an extremely dangerous treatment, and there is ample evidence that a pneumothorax induced when the bronchi are in such a condition may cause many complications, and that, apart from adhesions, it is probably the most important single factor in preventing a satisfactory pneumothorax. The complications which arise from endo-bronchial tuberculosis in artificial pneumothorax work are the presence of a collapsed lobe, which frequently remains collapsed permanently, making it very difficult to expand the lung, and the rupture of a tension cavity, especially if superficially situated, giving rise subsequently to a tuberculous empyema. Not only are these complications serious in themselves, but they are frequently irreversible.

The Treatment of Endo-bronchial Tuberculosis

The treatment of this condition falls into two categories: firstly, the treatment of the active disease, and, secondly, the treatment of the complications which arise from the stenosed bronchi.

In the first group of cases it is important to recognise that many endo-bronchial lesions heal on their own, without any active interference or any therapeutic measures. This can be stated dogmatically, for cases are frequently seen where there is evidence of old healed pulmonary tuberculosis, in which the patient has no history of the disease, but where, bronchoscopically

there is evidence of healed endo-bronchial disease—*i.e.*, a stricture. At the present time the active disease is invariably treated with streptomycin or P.A.S. or both. Streptomycin should be used immediately, but is probably better combined with P.A.S. in order that the tubercle bacilli should not become resistant to the streptomycin, or at least that development of this resistance should be delayed as long as possible, and as in the case of tuberculous laryngitis the results are satisfactory. Before the advent of streptomycin or P.A.S. the treatment involved painting the ulcer directly with caustic soda, in order to encourage fibrosis, but this probably gave rise to even greater stenosis than was necessary, because a certain amount of the astringent was invariably placed on the tissues surrounding the ulcer as well as on the ulcer itself. The results of this treatment were never very satisfactory and subsequent bronchoscopy showed little improvement in most cases, although some appeared to do well. These were probably the ones which would have healed spontaneously.

There are certain features which have to be considered in endo-bronchial disease. If the condition is one of redness and œdema without ulceration, if there are a few tubercles without ulceration, or if there are superficial ulcers involving the mucous membrane only, with relatively little disease in the lung fields, the response to antibiotics is good and there is no permanent deformity of the bronchus. In other cases, where there are deep ulcers penetrating beyond the superficial layers of the mucosa or where there is evidence of tuberculous granulation tissue indicating a fairly severe endo-bronchitis, while the treatment with antibiotics may be successful in that it heals the disease, bronchial stenosis is very liable to occur (Figs. 4 and 5), and with this various complications not necessarily tuberculous in origin. Apart from the active treatment, with antibiotics, of the bronchial disease, it is important to control the pulmonary lesion, for, as with tuberculous laryngitis treatment is primarily for the lung lesion, so with endo-bronchial disease the primary treatment is again for the pulmonary condition; and as soon as bronchoscopic evidence shows that there is no obstruction or partial obstruction of the major bronchi, or, in the case of a tension cavity, that this partial obstruction has been relieved, demonstrated by diminution of the cavity, then active treatment of the diseased area in the lung by collapse therapy should be considered.

In the second group, it is a question of treating the complications which arise from a stenosed or blocked bronchus (Fig. 6). Stenosis may give rise to localised emphysema if it is partial, but frequently, where a slight infection of the lung occurs, the partial block becomes complete owing to a small amount of sputum blocking the bronchus, and this will lead to collapse of the distal portion, or, again, to secondary infection of the distal portion of the lung, with abscess formation (Figs. 7, 8, 9 and 10). The collapsed portion of the lung, if apical, can often be treated by a partial thoracoplasty, and in many cases this is very satisfactory, but if basal it is impossible, in which case resection of the affected lobe is the correct treatment. The location of the stenosis will be the final factor upon which the exact operative procedure is based. It should be borne in mind that while the object of treating these patients is to heal the tuberculous lung and bronchi, a further aim is the conservation of as much healthy lung as possible. If a main bronchus is stenosed clearly

pneumonectomy is necessary; but if, on the other hand, a lobe is affected, a lobectomy should be performed whenever possible; and if only a segment of a lobe is affected, then a segmental resection is the ideal procedure. On the other hand, owing to adhesions, fibrosis and scarring, not infrequently the surgeon has to remove more lung tissue than is strictly necessary.

The M.R.C. trials of streptomycin treatment in endo-bronchial tuberculosis (*Lancet*, 1951), in a small series of 35 cases, show that the incidence of the disease was found to be approximately the same in both major bronchi, but it was uncommon to find bilateral ulceration. The patients were bronchoscoped before treatment and then at two-, four- and six-monthly intervals after treatment had commenced. There was marked improvement in 43 per cent. of the cases in the first two months, and 42 per cent. had slightly improved during this time. The final results showed that 68 per cent. had healed or were greatly improved, 20 per cent. had slightly improved, 9 per cent. showed no change, while 3 per cent. were worse. In 15 cases (43 per cent.) the affected bronchus was narrowed before treatment began, in 3 of these the stenosis increased during treatment, in 8 it remained unaltered, and in 4 it diminished. The narrowing in these 4 cases, as pointed out in the *Lancet*, must have been due to œdema or sub-mucous infiltration rather than fibrosis. In 20 per cent. of the total number of cases narrowing of the bronchus developed during treatment. The lesions in the lung varied considerably in these patients, but the numbers are small, so that no final conclusions can be drawn. However, the figures suggest that patients with no cavity showed a higher rate of healing than those with a cavity, and it was thought that this was unlikely to have arisen by chance. Subsequent follow-ups showed that the cases with endo-bronchial disease which had healed well did not tend to break down.

Summary

The history and bronchoscopic appearances of endo-bronchial tuberculosis are described, together with the results of treatment, and the Medical Research Council's findings. The etiology of the condition is discussed, also the complications which arise from the disease in its active phase and the stenosis which may subsequently occur.

I would like to thank Dr. L. J. Grant for his help with the historical references.

BIBLIOGRAPHY

BARNWELL, J. B., LITTIG, J., and CULP, J. E. (1937): *Amer. Rev. Tuberc.*, **36,** 8.
CAYOL, M. (1810): " Recherches sur la Phthisie Trachéale," Paris.
ELOESSER, L. (1931 and 1932): *J. Thorac. Surg.*, **1,** 194, 270, 373, 485.
EPPINGER (1880): Klebs' " Handbuch der pathol. Anatomie," 2, 293.
FLANCE, I. J., and WHEELER, P. A. (1939): *Amer. Rev. Tuberc.*, **39,** 633.
HEAF, F. R. G. (1924): *Lancet*, **2,** 698.
HEINZE, O. (1879): " Die Kehlkopfsschwindsucht," Leipzig.
JUDD, A. R. (1947): *J. Thorac. Surg.*, **16,** 512.
LAËNNEC, R. T. H. (1829): " Diseases of the Chest," English ed., 136.
LOUIS, P. C. (1825): " Recherches sur la Phthisie," 44.
MCINDOE, R. B. *et alia* (1939): *Amer. Rev. Tuberc.*, **39,** 617.
MORGAGNI, G. B. (1761): " De sedibus et causis morborum," Venice.

MORLOCK, H. V., and HUDSON, E. H. (1939): *Brit. Med. J.*, **1**, 381.
MORTON, R. (1694): "Phthisiologia," London.
REICHLE, H. S., and FROST, T. T. (1934): *Amer. J. Path.*, **10**, 651.
ROKITANSKY, C. (1842): "Handbuch der Patholog. Anatomie," **2**, 36.
SAMSON, P. C. (1936): *Amer. Rev. Tuberc.*, **34**, 671.
STOKES, W. (1837): "Dis. of Chest," 172.
"Streptomycin Treatment of Tuberculous Lesions of the Trachea and Bronchi." A Report to the Medical Research Council by the Streptomycin in Tuberculosis Trials Committee, *Lancet*, 1951, **1**, 253.
WARREN, W., HAMMOND, A. E., and TUTTLE, W. M. (1938): *Amer. Rev. Tuberc.*, **37**, 315.

By the historical method alone can many problems in medicine be approached profitably. For example, the student who dates his knowledge of tuberculosis from Koch may have a very correct, but he has a very incomplete appreciation of the subject.

SIR W. OSLER: *Aequanimitas*, London, 1946, p. 213.

Pathological anatomy has perhaps never afforded more conclusive evidence of the curability of a disease than it has in that of tubercular phthisis.

R. CARSWELL: *Pathological Anatomy*, 1857.

MEDIASTINITIS PRODUCED BY PENETRATING FOREIGN BODY IMPACTED IN THE ŒSOPHAGUS

By N. Asherson
From the Royal National Throat, Nose and Ear Hospital

Case I
(1939)

Perforation of the cervical (sub-cricoid) part of the œsophagus by a transversely impacted rigid spiked fishbone: cervical emphysema: detection by extravasation of bismuth into mediastinum: mediastinal abscess and empyema thoracis: operation with multiple post-operative sequelæ: recovery.

A female, aged 40, while eating fish some hours previously, swallowed inadvertently a long spiked fishbone, which immediately became impacted in the œsophagus. Following this she was unable to swallow on account of a persistent pricking pain located low down on the right side of the neck, where exquisite localised tenderness could be detected. The temperature and pulse were normal. The diagnosis made was of transverse impaction, with penetration, of a long, pointed, rigid fish (plaice) bone in the wall of the œsophagus. Pre-operative radiological examination was not available, owing to the lateness of the hour.

Four hours after impaction operation was performed, using pentothal and an intra-tracheal anæsthesia. Œsophagoscopy exposed a long, rigid, spiked bone 2 inches long transversely impacted, the point having penetrated the wall of the œsophagus in the sub-cricoid region on the right for about ½ inch. The bone was removed; there was much hæmorrhage during the operation: no extra-œsophageal complication was suspected.

Post-operative Course—Day 1

The following morning the pricking pain on swallowing had disappeared: the patient now lay immobile and rigid, fearing to breathe. She complained of a continuous pain referred to the right side of the chest at about the angle of the scapula, in the axilla. There was also tenderness in the right supra-clavicular region. Temperature 99°, pulse 108: slight dysphagia.

The patient was allowed only sterile water by mouth and was put on a bismuth emulsion three times daily. This therapeutic measure was of inestimable value in ascertaining the exact condition of affairs when the patient was X-rayed later.

Forty-eight Hours after Impaction

As this was a Sunday an X-ray was still not available. The patient stated she was better, but without conviction. She lay motionless: tongue dry: no

vomiting: bowels open with enema: no pain in axilla, but some discomfort referred to the xiphisternum. Some tenderness and crepitus in the right supra-clavicular space. Chest—tubular breathing medial to the scapula on the right and weak breath sounds. Evening temperature 101°, pulse 104.

Diagnosis.—Surgical emphysema, with mediastinitis, following perforation of the œsophagus.

The patient was still only on sips of sterile water and a thin bismuth emulsion every four hours.

Day 3

The radiological examination disclosed " Surgical emphysema in the right supra-clavicular area. *Bismuth free in the upper mediastinum*, presumably from a fistula in the œsophagus." (This indicates the importance of an antero-posterior picture taken before any opaque mixture is administered by the radiologist at the time of the examination. The extravasation of bismuth outside the œsophagus was of paramount diagnostic importance, as the radiologist had *not* given a preliminary opaque swallow.) " Partially collapsed right base of lung. Right diaphragm elevated. Opaque area to the right of the upper mediastinum suggests a mediastinal abscess. There is a diffuse margin to the swelling."

Temperature 101°, pulse 120. Very weak, perspiring freely. Chest tenderness over the right supra-clavicular space, where there is crepitus (emphysema). Swallowing painless, but pain persists low down on the right side of the chest in the mid-axillary line.

The radiological picture discloses a mediastinal mass (probably an abscess) and a fistula into the œsophagus (emphysema and extra-œsophageal bismuth). The perforation is revealed by the extravasation into the mediastinum of the bismuth previously administered, high up. Cervical mediastinotomy was advised.

A physician and thoracic surgeon, in consultation, were against surgical intervention at this stage, the mediastinal shadow being deemed an adenitis. They failed to assess accurately the significance of the free bismuth in the mediastinum. To the laryngologist the " writing on the wall " of the bismuth in the mediastinum was all too clear. The operation for drainage was promptly proceeded with, seventy hours after impaction.

The mediastinal abscess was drained cervically through an incision made along the anterior border of the sterno-mastoid after exposure, which was retracted laterally with the great vessels. A finger inserted towards the tracheo-œsophageal junction, along the tracheal wall, entered a large abscess cavity containing fœtid pus. The cavity extended into the thorax along the œsophageal-tracheal groove to the retro-œsophageal region. The cavity was aspirated and tube drainage instituted. Œsophagoscopy revealed a normal intact œsophagus. No perforation was visible, or it was so small as to elude detection. The patient was fed by use of an œsophageal feeding tube and an intravenous drip.

The fluid was aspirated from the right base after twenty-four hours by intercostal drainage.

7th Day: Cavity still draining: mediastinal mass unchanged.

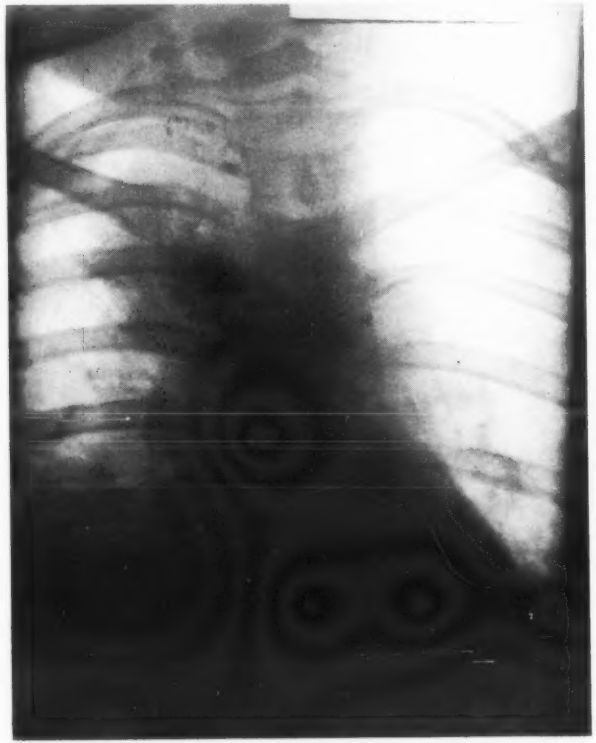


FIG. 1.—DAY 3. ANTERO-POSTERIOR VIEW OF THE CHEST (NO OPAQUE SWALLOW HAD BEEN GIVEN).
There is extravasation of the bismuth in the large globular shadow to the right mediastinum which clinches the diagnosis of a perforation of the œsophagus.

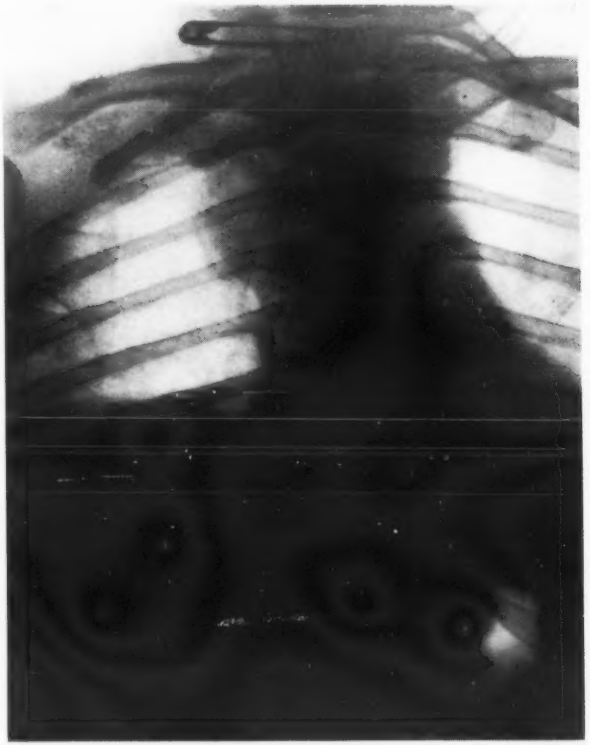


FIG. 2, CASE 1.—MEDIASTINAL ABSCESS.
Day 6 after cervical drainage. Note changes at base of right lung.

To face p. 70

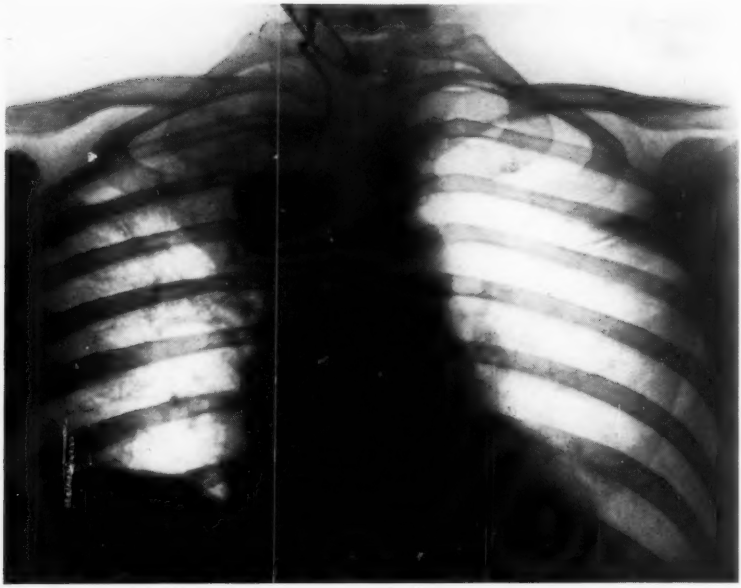


FIG. 3, CASE 1.—ANTERO-POSTERIOR VIEW.

The mediastinal abscess cavity 4 weeks later. LIPIODOL has been instilled into the cavity through the drainage tube (which shows up in the plate) in the neck. This picture gives the size, shape, and situation of the suppuration. The right base is clear. This plate was taken prior to the posterior thoracotomy.

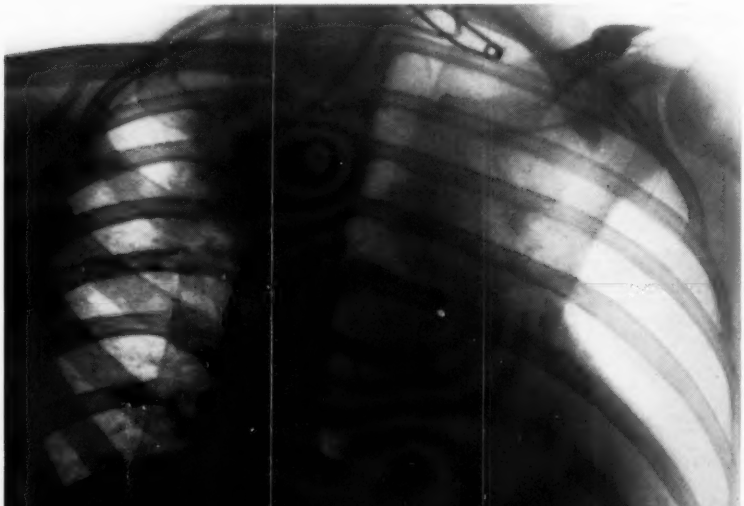


FIG. 4, CASE 1.—RIGHT OBLIQUE VIEW.

To face p. 71

11th Day: Temperature up to 101°, pulse 110-180. Blood count—reds 4,000,000: colour index 1: whites 24,000.

12th Day: Husky voice due to right recurring laryngeal nerve paralysis. Swallows normally.

14th Day: Cough.

15th Day: Rigor: thrombosis of the internal jugular vein.

21st Day: Extensive urticaria: right arm swollen at wrist. Temperature 99°.

29th Day: Lipiodol injected into mediastinal abscess: still large: coughs up sputum.

30th Day: Bronchial fistula: when patient blows out her cheeks air bubbles pass wound.

32nd Day: Temperature 101°: pulse 120. Posterior drainage.

70th Day: Doing well.

Seven years later—alive and well.

The mediastinotomy and subsequent operations were performed by the late Mr. J. E. H. Roberts.

The complicated course of this case may be summarised thus:

1. Impaction of bone with perforation in the sub-cricoid region of the œsophagus.
2. Removal by œsophagoscopy.
3. Mediastinal abscess drained through a cervical approach.
4. Empyema thoracic at right base.
5. Paralysis of the right recurrent laryngeal nerve.
6. Bronchial fistula.
7. Thrombosis of the internal jugular vein.
8. Thrombosis of the right subclavian vein.
9. Posterior thoracotomy, first stage followed by
10. Right pneumothorax.
11. Posterior drainage of the mediastinal abscess.

Recovery.

The history and signs, pre- and post-operative, are given, and are significant in the light of the complication and appropriate treatment: the diagnostic significance of the first X-ray is stressed. Attention is drawn to the importance of: (1) Prescribing for every post-operative (*i.e.*, œsophagoscopy) case, in the first few days after suspected perforation of the œsophagus, a bismuth mixture and sterile water only. This applies however minute the original breach (*e.g.*, in this case it was the point of a fishbone, and œsophagoscopy on the third day disclosed a normal intact œsophageal mucosa. No perforation could be seen). (2) Taking an antero-posterior X-ray of the chest and neck on the second and the third day. This would show any emphysema of the tissues of the neck, mediastinal swelling, or even extravasation of bismuth into the mediastinum.

se p. 71

Case 2

Perforation of the sub-cricoid region of the œsophagus by an impacted spiked fishbone; retro-œsophageal abscess; drainage through posterior œsophageal wall via œsophagoscopy: recovery.

This case illustrates—

1. The formation of a mediastinal abscess in the posterior mediastinum resulting from a perforating foreign body.
2. Rupture of the abscess into the œsophagus through a fistula in the posterior wall.
3. Surgical drainage through the posterior wall of the œsophagus via an œsophagoscopic approach.

Case 3
(1934)

A child of 7, four days previous to admission to hospital, swallowed a fishbone, complaining of an immediate pain in the left side of the neck, low down, and of difficulty in swallowing. Taken to another hospital immediately, the history was ignored; the child was permitted to go home. Three days later the temperature was 102°, and there was a left-sided acute torticollis. The child was coughing up foul pus. There was a tender spot in the neck low down on the left. An X-ray plate showed a foreign body. A bismuth swallow revealed no obstruction. Chest signs were absent. On mirror examination, pus was welling up from behind the epiglottis. Œsophagoscopy revealed a collection of foul pus in the hypo-pharynx emanating from the cricoid region of the œsophagus. On aspirating away the pus granulations were observed on the left posterior part of the œsophagus (the walls of which were inflamed) in the sub-cricoid region. Pus was exuding through the granulations from the abscess and the flow was accelerated by the pressure of the beak of the œsophagoscope. A rigid spike of a fishbone was observed jutting out antero-posteriorly for about $\frac{1}{2}$ inch from the centre of the granulations. The bone was firmly impacted, and when seized with the forceps was found jammed and immovable. On withdrawing the forceps and inserting another, the bone suddenly became dislodged and disappeared down the œsophagus, the rest of which was normal.

The next day the dysphagia and the torticollis disappeared; the temperature was still 102°. Recovery was complete.

Case 4

Idiopathic spontaneous perforation of the œsophagus producing surgical emphysema of the neck: recovery within a few days.

J. S., airman, aged 21, on waking one morning complained of a painful stiff neck and rapid breathing. He found his usual collar too small to put on, and there was some difficulty in swallowing. On examination subcutaneous emphysema with crepitus was present at the lower part of the neck, more

marked on the left side, but also slightly on the right. There was no cyanosis, no cough, no pain in the chest. The dyspnœa and dysphagia resolved within a few days. All the emphysema resolved within forty-eight hours. No physical signs were detected in the chest and œsophagus. The X-ray of the chest was normal. There was no history of a foreign body. (The similarity of the sequence to Case 1 will strike the observer, and in view of this can it not be inferred that this patient had had a minute perforation of the œsophagus by a small pointed foreign body, such as a spiked bone?)

The patient was examined clinically and radiologically by Dr. Philip Ellman and another chest physician one month later, and both passed the chest as normal and free from any clinical or radiological signs of tubercle. This, I consider, excluded a chest source. This spontaneous emphysema was so rare that neither of the two experienced chest specialists had encountered such a case previously—and their total clinical experience covered fifty years. The only pathology discovered by me, seventeen days later, was an opacity of the left maxillary antrum, which incidentally had produced a left aero-otitis (the patient was an air trainee and the latter had developed after exposure to the pressure chamber).

It may be fairly questioned whether the proportion of cures of confirmed consumption is greater at the present day than in the time of Hippocrates.

SIR JAMES CLARK: *A Treatise on Pulmonary Consumption*, London, 1835, p. 6.

However dangerous diseases of the chest may be, they are, nevertheless, more frequently curable than any other severe internal affection.

R. T. H. LAENNEC: *A Treatise on the Diseases of the Chest and on Mediate Auscultation*, translated by John Forbes, 3rd ed., London, 1829, Vol. 2.

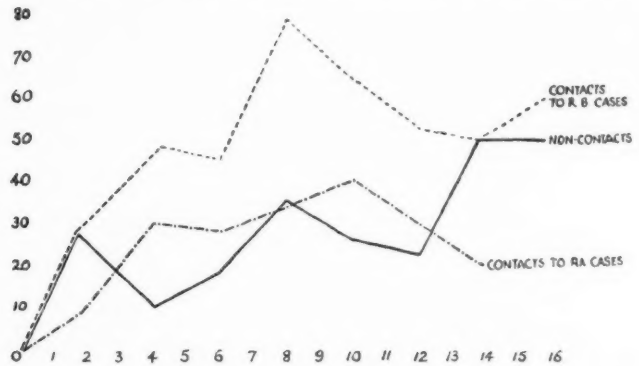
A TUBERCULIN SURVEY OF CHILDREN ATTENDING A CHEST CLINIC*

By William D. Gray
From the North Liverpool Chest Clinic

During the twelve months August 1948 to July 1949, 438 children at this clinic were all given a tuberculin jelly test, and I have analysed the material in an attempt to assess the number of cases suitable for B.C.G. vaccination in this area. The jelly was applied to the skin after thorough cleansing with methylated ether, and then covered with sticking plaster. The test was read after forty-eight hours. The technique described in Memorandum No. 322, B.C.G. (Ministry of Health, 1950) includes the preliminary stroking of the skin with sandpaper. The jelly test is greatly superior to the dry patch test formerly employed, as is demonstrated by a comparison of 58 cases, in which I found 33 were positive to the jelly, but only 12 to the dry patch, which was therefore abandoned.

Jones Davies (1950) has made a similar comparison in rural Wales. He used both tests on a series of 88 boys between the ages of 5 and 14. Seventy-six were positive to both tests, 11 negative, and 1 negative to the Mantoux test but positive to the jelly test. It appears, therefore, that the latter is adequate for routine clinical work.

Table I shows the results of the survey divided into three groups according to whether the children were contacts of cases in whom tubercle bacilli have never been discovered (Class RA, Ministry of Health classification), or to those in whom tubercle bacilli have been or are being discovered (Class RB), and non-contacts, children referred on account of ill-health by general practitioner or school medical officer. The table shows that 122 cases (51 per cent.) contacts to RB cases are tuberculin positive, including 8 cases with signs of disease, 6 under 5 years old, 2 over 10—a morbidity of 2 per cent. of all contacts



* Based on a paper read before the North-Western Tuberculosis Society, May, 1950.

examined, or 3·5 per cent. of contacts to RB cases. Twenty-five per cent. of contacts to RA cases are positive, and 29 per cent. of non-contacts are positive.

It is interesting to note the close relationship between the last two groups, as the highest proportion of positives would be expected in the first group.

The graph shows the result in accordance with age. It shows that at all ages the contacts to RB cases show a higher percentage of tuberculin positive reactors.

Table II gives results from other sources, some of which can be compared with the present survey. Unfortunately, some surveys did not give the same details, and there are therefore several blanks in the table.

(1) Brian Thompson (1947) at Ealing found 66 per cent. of home contacts positive to Mantoux, 1 in 100 at 1 year old, and 80 per cent. at 5 years old, but does not subdivide cases according to whether the source of infection was in RA or RB groups.

TABLE I.—SURVEY OF PATIENTS TESTED WITH TUBERCULIN JELLY FROM AUGUST 1948 TO JULY 1949

Age Group Years	*Contact to R.A. Cases*	*Contact to R.B. Cases*	*No Contact*	*Cases of Tuberculosis*		*Total*
				Contact to R.A. Cases	*Contact to R.B. Cases*	
Tuberculin-Negative Reactors						
0–3	32	34	5	0	0	71
3–5	9	17	9	0	0	35
5–7	12	17	18	0	0	47
7–9	12	5	14	0	0	31
9–11	11	12	3	0	0	26
11–13	7	15	10	0	0	32
13–15	8	12	2	0	0	22
15–17	0	2	1	0	0	3
17–19	0	1	0	0	0	1
Total	91	115	62	0	0	268
Tuberculin-Positive Reactors						
0–3	3	11	2	0	3	19
3–5	4	14	1	0	3	22
5–7	5	14	4	0	0	23
7–9	6	23	3	0	0	32
9–11	7	22	1	0	0	30
11–13	3	16	3	0	1	23
13–15	2	11	2	0	1	16
15–17	1	3	1	0	0	5
17–19	0	0	0	0	0	0
Total	31	114	17	0	8	170

(2) F. J. W. Miller (1947) in Newcastle-upon-Tyne tested 213 contacts to open positive cases with 1 in 1,000 tuberculin, finding that 50 per cent. were tuberculin reactors between 2 and 3, and 74 per cent. at 5 years. Twenty per cent. contacts to sputum-negative cases were tuberculin reactors when

first examined. Only 51·6 per cent. of all contacts to open positive cases were positive on first examination, and he comments on this high proportion of negative reactors.

TABLE II.—COMPARISON OF RESULTS

	North Liverpool 1948-9	*Percentage of Tuberculin Reactors*			
		Ealing 1942-5	*Newcastle-on-Tyne* 1941-5	*Bedfordshire* 1948-9	*S.-W. Durham* 1947-8
Contacts to R.B. cases	51	66	20·5	21·5	—
Contacts to R.A. cases	25				
Non-contacts	20	49·6	—	—	—
Contacts to open positive cases	—	—	51·6	55·5	80

(3) Shaw and Wynn Williams (1949) found 55·5 per cent. contacts to open positive cases were tuberculin reactors, and 21·5 per cent. contacts to RA cases.

(4) In south-west Durham I found that 63 out of 78 contacts to open positive cases were positive to the jelly test, corresponding very closely to the official estimate of 80 per cent. tuberculin reactors to open positive cases.

Owing to the high proportion of negative reactors in the present survey, I decided to analyse this group in more detail.

(1) Thirty-five cases had not been in contact with an open positive case.

(2) Eleven cases had been in contact with open cases at some time, which were now closed or the patient had died.

(3) This left 69 cases who were contacts to open positive cases, but were negative reactors, 60 per cent. of my negative reactors. These cases would be suitable for BCG vaccination.

(4) Table III shows that the source of infection in these negative reactors proved to be the father in just over half the cases, and the mother only in 12. One would expect to find few negative reactors where the mother is the source, as children are usually in closer contact with the mother than with any other member of the family.

TABLE III.—SOURCE OF CONTACT IN 69 NEGATIVE REACTORS

Source	*No.*
Mother	12
Father	35
Brother or sister	13
Uncle or aunt	5
Grandmother	3
Grandfather	1

Summary and Conclusions

(1) The tuberculin jelly test is a useful routine method of sorting out tuberculin reactors, but should be used in accordance with the instructions in Memorandum No. 322, B.C.G., to obtain the most accurate results. If in doubt the Mantoux test should be done.

(2) In surveys of this kind it is desirable to divide contacts into groups in accordance with the classification and activity of the lesion in the original source of infection.

(3) Of 438 children examined in a year, 69 should have received B.C.G. had it then been available.

(4) Contact examination should be directed primarily to the examination of contacts of open positive cases, especially among under fives and adolescents.

(5) The father is a less dangerous source of infection than the mother.

I should like to express thanks to my health visitors and clerical staff for helping me with this work, and also to the North-Western Tuberculosis Society for allowing me to submit this paper for publication.

REFERENCES

Jones Davies, T. E. (1950): *Brit. J. Tuberc.*, **44**, 1.
Miller, F. J. W. (1947): *Brit. Med. J.*, **2**, 91.
Ministry of Health (1950): Memorandum No. 322, B.C.G.
Shaw, J. B., and Wynn-Williams, N. (1949): *Tubercle*, **30**, 218.
Thompson, B. C. (1947): *Arch. Dis. Childh.*, **22**, 1.

REVIEWS OF BOOKS

Thoracic Surgery. By Richard H. Sweet, M.D. Philadelphia: W. B. Saunders Company. 1950. Pp. 345, 154 figs. Price 50s.

A work or publication on thoracic surgery from someone with the experience and knowledge of Dr. Sweet must always be a welcome addition to literature. In this book he sets out to give a comprehensive description of surgical anatomy and a standard technique which can be easily followed from the descriptions and illustrations. There is, however, little description of the actual diseases for which the operations are performed, or of any indications for which surgery might be undertaken. This is made quite clear in the introduction to the book, but naturally it loses some of its value by these absences.

There is a detailed description of all the accepted standard operations and exposures, going into extreme detail in some cases, but it is written with the clarity that comes only of a very extensive experience.

The section on excision of lung is admirably written, and a clear account of possible variations and complications is given. Also, considerable attention is given to the post-operative treatment and handling of these patients. Similarly, the section on œsophagus, as might be expected from the author's experience, is most satisfactory. Surgery of tuberculosis, however, does not come in for such detailed attention, and possibly more space could have been allotted to these operations which occupy so much of the average thoracic surgeon's time. On the other hand, it must be admitted that if this work is primarily for general surgeons, the character of tuberculous work is not so likely to bring these operations within their scope.

The production leaves nothing to be desired, and many of the illustrations are of the greatest value, though in one or two instances they fail by being too small and are not sufficiently diagrammatic for clarity. This is particularly so in the case of cardiac operations, but many of the other illustrations, notably those concerned with the anatomy of the lung and its vascular supply, are extremely clear and valuable. One can only hope that Dr. Sweet will some day provide a book which will illustrate the clinical side of the subjects that he has so well dealt with from the technical aspect.

T. H. S.

Diseases of the Heart and Circulation. By Paul Wood. Eyre and Spottiswoode. 1950. Pp. 589, 354 figs. Price 70s.

The close anatomical and functional relationship between the heart and lungs, which work as a single oxygenating unit, indicates that disorders or deranged function in the one may easily lead to secondary changes in the other, and that damage to any part of the circuit will affect the efficiency of the whole. The modern chest physician who recognises the need for a specialised knowledge of intrathoracic disease, including pulmonary tuberculosis, is constantly encountering symptoms such as dyspnœa, cyanosis, cough and hæmoptysis, which may be common to both heart and lung disease. The correct assessment of these symptoms requires a basic knowledge of these subjects, and this book by a distinguished authority on cardiovascular disease should prove an invaluable addition to the shelves of the chest physician. Although it has been

written primarily for graduates interested in clinical cardiology, the author states that the needs of students, general practitioners and specialist physicians in other fields of medicine have been constantly borne in mind. Our own reading suggests, however, that it is somewhat advanced for the undergraduate student and average busy general practitioner.

Dedicated to a pioneer in cardiology, Sir John Parkinson, the book maintains a proper balance between bedside medicine as it was understood by the older school of clinicians and the utilisation of modern technical developments—in fact, between the practical and the academic, the past and the present. These technical developments include electrocardiography, teleroentgenography, kymography, angio-cardiography, cardiac catheterisation, etc., to which Dr. Paul Wood has himself in no small measure contributed. From his reputation as a sound and stimulating clinical teacher, with whom speciality is nowhere divorced from general medicine, perusal of this book shows that in spite of full consideration of all these technical developments there is here no danger, as is emphasised in the preface, " of our clinical heritage being lost in the welter of figures thrown up by machines." Indeed, as Dr. Wood insists, modern methods must themselves suffer if this tendency is not checked.

The importance attached to history-taking and full clinical examination not only of the cardiovascular system, but also of the lungs in particular and, to a lesser degree, of all other systems, is highly commendable and is characteristic of the wide embrace of the subject. The interpretation of physical signs in the light of modern advances is admirable, and the refusal to foster traditions which have little factual basis removes false sentiment or " debunks " many alleged signs—*e.g.*, the limitations of percussion of the heart, the so-called distinction between relative and absolute cardiac dullness, and statements handed on from one textbook to another which cannot, in fact, be verified.

For this reason we were surprised to read that " the incidence of pulmonary tuberculosis in cases of mitral stenosis is lower than in the general population." This contention still appears in current teaching, but Davis (*Amer. Rev. Tuberc.*, 1947, **55**, 457), in fact, found that of 725 patients in the London County Council Hospital services suffering from active pulmonary tuberculosis 1 per cent. had mitral stenosis. Various observers in a study of the epidemiology of rheumatism have noted the incidence of rheumatic heart disease to be approximately 1 per cent. of the general population. Accordingly, the incidence of rheumatic heart disease in pulmonary tuberculosis seems to be not less than in the general population, which has also been our personal experience.

The arrangement of the contents of the volume has been mainly determined by etiological considerations, and the chapter on pulmonary heart disease will be of considerable interest to the chest physician, for it deals very concisely with the cardiac and circulatory disturbances that result from diseases of the lungs, the pulmonary arteries and their branches.

The book is profusely illustrated and the electrocardiographs are magnificent. While a few of the chest X-rays are good, chest physicians will probably feel that in many the quality is below standard.

This is certainly a leading English textbook on diseases of the heart, combining all the newer technical data with sound clinical procedure. The book can be strongly recommended to all chest physicians interested in the wider aspects of intrathoracic disease, and it is sincerely to be hoped that its high cost will not act as a deterrent to its deservedly wide recognition.

P. E.

Pneumonies à Virus et Pneumonie Primitive Atypique. By RENÉ FRANÇOIS. Paris: Vigot Frères. Pp. viii + 194, 17 figs.

Clinical experience has shown that there has been a great change in the prevalent type of acute respiratory infection in the past few years. Whereas there was not long ago a high incidence of bacterial pneumonia with a considerable case mortality, there is now a much greater incidence of virus infection of the lungs, which runs a more benign course. Attention was first drawn to this atypical form of pneumonia as long ago as 1872 by Woillez, but it was not until about fifteen years ago that the condition began to attract serious attention. Within these few years there has been a large volume of literature originating from most of the civilised world, and references to more than 500 papers are included in this monograph.

The author considers that the characteristic features of atypical virus pneumonia are a bronchiolitis which affects the tertiary bronchi, with interstitial monocytic infiltration along the bronchioles and the septa, and he regards the factor of alveolar exudation as being less important. The clinical features are the paucity of physical signs on examination of the chest, the gradual evolution of the disease, and its benign course.

The evidence yielded by laboratory examinations is considered in detail, with special reference to cold agglutinins, the exact significance of which is still obscure. Mention is made of observations on the agglutination of non-hæmolytic streptococci and also of the agglutinin T described by Burnet in Australia, but no fresh information is brought forward.

The clinical features of the disease are discussed in detail, and description of the complications is particularly full. It is somewhat surprising to read that fractures of ribs are one of the features in primary atypical pneumonia.

The diagnostic features are considered to be an insidious onset, with dry cough, relatively slow pulse and normal respiration rate, with few signs on auscultation. Radiologically there are usually indications, even when physical signs are absent, of consolidation in the lung fields, the earliest signs being an interstitial spread from the hilum.

The second section of the monograph closes with a description of the pathological anatomy of the condition. This is of necessity concise, for the disease carries a low mortality. The main macroscopic features are congestion and a loose type of consolidation, rather than true hepatisation. Microscopically there is early ulceration in the bronchioles, and a mononuclear exudate with few organisms. Stress is laid on the fact that the bronchioles are usually found to be dilated. Lobular atelectasis is often present.

The third and final section consists of a series of clinical records of forty-eight cases which had been studied in considerable detail.

This monograph is a clear account of virus pneumonia as we know it at present, and the bibliography conveys an excellent impression of the very extensive literature on the subject.

J. M.

Broncho-œsophagology. By C. Jackson and C. L. Jackson. Saunders. 1950. Pp. 366, 260 figs. Price 63s.

The name of the Chevalier Jacksons commands the respect and attention of everyone whose interests lie within the sphere of broncho-pulmonary disease. Their pioneer work in bronchoscopy has made possible direct study of the anatomy, physiology, pathology, diagnosis and treatment in relation to

diseases of the tracheo-bronchial tree. It has, moreover, during the past twenty-five years opened an entirely new chapter in intrathoracic disease. Similarly, diseases of the œsophagus have been placed on a more scientific basis through the introduction of the œsophagoscope.

The Jacksons have combined the two subjects they designate "broncho-logy" and "œsophogology" into one department of medical science, to which they have given what is, in our view, a by no means euphonious name, "broncho-œsophagology." Its field is the maintenance of the two lines of communication on which life depends for its supplies—viz., the air passages and the food passages.

This highly specialised study has not yet taken root in this country, although certain laryngologists and chest surgeons include it within their province. It is, moreover, well known that the pulmonary complications associated with œsophageal lesions occur in such conditions as achalasia of the cardia, pharyngeal diverticulæ, carcinoma of the œsophagus, congenital short œsophagus, etc. Frequent small aspirations are known also to be responsible for pulmonary fibrosis, aspiration and "dysphagia" pneumonias, whereas a single large aspiration may lead to the formation of a lung abscess.

Although a combined study of this nature is justifiable, such narrow specialisation is perhaps excessive, particularly in view of the fact that the subject might well fit into the wider sphere of intrathoracic diseases as a whole. This consideration apart, such criticism detracts in no way from the intrinsic value of the book.

It is divided into two parts, of which Part I deals with bronchology, including among other features the anatomy of the tracheo-bronchial tree and lungs, foreign bodies in the air and food passages, direct laryngoscopy, bronchoscopy and its practical aspects and obstructive laryngo-tracheal diseases. Part II discusses the anatomy and physiology of the œsophagus, œsophagoscopy and its practical aspects, and diseases and abnormalities of the œsophagus.

Both sections are beautifully illustrated, and there is an extensive bibliography. The book is of interest to laryngologists, chest physicians and surgeons, and to all concerned with diseases of the œsophagus. It contains a wealth of information and maintains throughout an extremely high standard.

P. E.

BOOKS RECEIVED

The following books have been received and reviews of some of them will appear in subsequent issues.

1. *Medical Treatment.* Edited by Geoffrey Evans. Butterworth. 1951.
2. *Estenose Bronquica No Decurso da Tuberculose.* By Aloysio de Paula. 1950.
3. *Les Lipoïdes dans les Bacilles Tuberculeux et la Tuberculose.* By L. Negre. Paris: Masson et Cie. 1951.

NOTICES

THE OXFORD CONFERENCE ON TUBERCULOSIS AND DISEASES OF THE CHEST

JULY 16-21, 1951

THIS Conference, which has been called during the Festival of Britain, is designed to display thought and work on tuberculosis and diseases of the chest by men and women from Great Britain, and also to stimulate discussion.

The following professional organisations are the sponsors:

The Faculty of Radiologists.
The Society of Thoracic Surgeons.
The Tuberculosis Society of Scotland.
The Society of Medical Officers of Health.
The British Pædiatric Association.
The British Tuberculosis Association.

The sponsors hope that many doctors from Europe and all parts of the world will wish to attend this important conference. Members will be housed in Balliol, St. John's and Trinity Colleges, and the Conference sessions will be held the other side of St. Giles's Street from the colleges in the Taylor Institution. There will be room in Balliol College for a limited number of women doctors, but there will be no accommodation in any of the colleges for married couples.

Members of the Conference will assemble on Monday evening, July 16. The next three days, July 17, 18 and 19, will be devoted to lectures and discussions. On the Friday, July 20, the Conference will disperse to various thoracic centres throughout the country, where members will have the opportunity to see operations, demonstration of techniques, etc.

Throughout the Conference there will be social engagements at which members and their wives will be able to meet their colleagues under less formal circumstances. There will be a reception and grand dinner on the evening of July 19.

PROGRAMME OF TITLES AND SPEAKERS FOR THE THREE DAYS JULY 17, 18, 19

Tuberculin Surveys
Dr. Marc Daniels (Medical Research Council Research Staff), Dr. Margaret Macpherson (Brompton Hospital).

Vaccination with the Vole Bacillus
Dr. A. Q. Wells (Oxford), Dr. J. Young (Cambridge).

Treatment of Tuberculous Meningitis
Dr. Honor Smith (Oxford), Professor R. S. Illingworth (Sheffield).

Present Position of Chemotherapy in Tuberculosis
Dr. J. W. Crofton (Brompton Hospital), Dr. L. E. Houghton (Harefield Hospital), Dr. Christopher Clayson (Lochmaben Sanatorium).

Bronchiectasis in Children
Mr. A. L. d'Abreu (Birmingham), Dr. J. H. Hutchinson (Glasgow).

Rehabilitation and Resettlement
Dr. J. E. Geddes (Birmingham).

Cardiac Surgery
Mr. R. C. Brock (Brompton Hospital), Mr. Price Thomas (Brompton Hospital), Mr. Oswald Tubbs (Brompton Hospital), Mr. Holmes Sellors (London Chest Hospital).

Pneumoconiosis
Dr. C. M. Fletcher (Pneumoconiosis Research Unit).

Pulmonary Resection for Tuberculosis
Dr. F. H. Young (Brompton Hospital), Mr. Ronald Edwards (Liverpool), Mr. V. C. Thompson (London Chest Hospital).

Further particulars may be obtained from the Hon. Secretary, Dr. Stephen Hall, 16, Grosvenor Place, London, S.W.1 (tel. Sloane 2115).

NATIONAL ASSOCIATION FOR PREVENTION OF TUBERCULOSIS

A REFRESHER Course for doctors and social workers is being arranged by the NAPT Northern Ireland Branch at the Whitla Medical Institute, Belfast, from May 9 to 11, inclusive.

The subjects for the Doctors' Course include Epidemiology—infection, the role of nutrition, employment schemes; Radiology—the management of the minimal lesion, pulmonary tuberculosis and differential diagnosis, technique in chest radiography and tomography; Treatment—chemotherapy and antibiotic treatment, bacteriological control of chemotherapy, the role of pulmonary resection in the treatment of pulmonary tuberculosis.

The Social Workers' Course will include Epidemiology—contact examination and preventive methods, household disinfection, the nursing of the tuberculous patient in the hospital and in the home, after-care of the sanatorium patient.

The fee for the Doctors' Course is three guineas; for the Social Workers' Course, one guinea, and particulars can be obtained from Miss J. L. Heslip, 28, Bedford Street, Belfast.

MATRONS' RECOMMENDATIONS ON NURSING SHORTAGE

THE February issue of the *NAPT Bulletin* initiates a new series of authoritative articles on housing. In an editorial it is pointed out that the housing shortage is worse than before the war by 600,000 houses, and that the only way to remedy the position is by strong pressure of public opinion. More houses is one of the principal means of preventing tuberculosis.

The first article in the housing series is by Mr. Norman H. Walls, Director of the Housing Improvement Association, and deals in a reasoned and practical way with the shortage. Mr. Walls shows that over a million houses are required, and that the present rate of building is doing nothing to reduce the deficiency. " The whole subject," he states, " is one of bottomless confusion." Varying rents, differing rates of subsidy and difficulties imposed by central control all contribute to the chaos. He believes that, given a sense of reality, the problem is not insuperable, and that it is a question of proper industrial organisation and economics. Subsequent articles will deal with rural areas,

repairs and rehabilitation of old structures, separate housing schemes for tuberculous families, and the position in Scotland.

This issue of the *NAPT Bulletin* also contains an interesting symposium of recommendations on the nursing shortage, by nine sanatorium matrons. There is remarkable unanimity on the chief recommendations, which include the development of a new attitude—both amongst the public and amongst nurses—towards tuberculosis nursing as a worthwhile job with no more risk than any other, given proper precautions. Open days, when the public can visit sanatoria, are proposed, and many practical suggestions are made regarding the provision of amenities and good living conditions for nurses. The inclusion of three months' tuberculosis training in general training is strongly advocated, and also the recognition of the British Tuberculosis Certificate by the General Nursing Council to reduce general training time.

IMPROVEMENTS IN TUBERCULOSIS POSITION

More Beds and Nurses—Fewer Deaths and Cases

We have received the following memorandum from the Ministry of Health.

Figures showing big advances in the fight against tuberculosis are published by the Minister of Health. The number of beds and nurses has gone up, and there is a big fall in deaths from tuberculosis. New cases are also fewer.

In July 1950 hospital boards were asked to make a special drive to bring beds into use for tuberculosis patients. In the six months up to the end of last year 761 new beds were provided and 386 reopened, a total of 1,147. Since the National Health Service began in July 1948, up to June 1950, 1,506 new beds were opened and 897 reopened, a total of 2,403. Altogether, 3,550 extra beds are in use, and there is the promise of more to come.

Nursing staff is also increasing. The year ending September 30, 1950 saw 705 extra whole-time nurses and 153 part-time nurses recruited to the staffs of sanatoria and tuberculosis hospitals.

Deaths have decreased sharply. Provisional figures for the first six months of 1950 show a drop of 17·7 per cent. in the numbers, compared with the same period in 1949. This is much larger than for many years past, and compares with a drop of 5·6 per cent. in the same periods of 1948 and 1949. Taking respiratory tuberculosis alone, the number of deaths fell by 1,671 (compared with 247) or 17·4 per cent. (compared with 2·5 per cent.). Much of the fall may be attributed to the increasing use of new methods of treatment, such as streptomycin and para-amino-salicylic acid, but increased services have also played a part.

Of course, the returns for one half-year must be interpreted with caution, but the gain is large enough to warrant the belief that new methods are beginning to show results. This is a time, states the Ministry, for redoubled effort to bring tuberculosis under control, not for relaxation.

The number of new cases is dropping too. For several years past notifications of new cases have been increasing, mainly because of a rise in the number of respiratory tuberculosis cases. But provisional figures for 1950 show an overall drop of 5 per cent. and a drop of nearly 4 per cent. in respiratory cases, compared with a rise of 0·5 per cent. shown in the corresponding returns for respiratory cases in 1949 over 1948.

JOINT TUBERCULOSIS COUNCIL

A MEETING of the Joint Tuberculosis Council was held on February 17, 1951, under the chairmanship of Dr. Peter W. Edwards, who opened the proceedings by paying tribute to the memory of the late Dr. A. P. Ford, who had died suddenly since the last meeting and who had been a representative of the British Medical Association on the Council since 1942 and Honorary Treasurer of the Council since 1944.

The following officers were elected for the year 1951-2: Chairman: Dr. Peter W. Edwards. Vice-Chairmen: Dr. N. Tattersall, Professor F. R. G. Heaf. Hon. Treasurer: Dr. N. J. England. Hon. Secretary: Dr. R. L. Midgley.

It was reported that specimen copies of the forms of record for chest clinics which had been approved by the Council had been sent to the appropriate Ministries, Senior Administrative Medical Officers of Regional Hospital Boards, British Tuberculosis Association, Scottish Tuberculosis Society, and others.

The Council is sympathetic towards the British Students' Health Committee's efforts to set up a post-cure establishment where tuberculous students can continue their studies whilst undergoing rehabilitation. Dr. R. R. Trail and Mr. E. S. Evans were appointed as representatives of the Council on the Committee.

The Council considered a request from the Ministry of Health for a definition of tuberculosis in connection with the proposed new Notification Regulations. The Council submitted the following definition: " Tuberculosis means any condition diagnosed as due to the presence of a tuberculous lesion which is judged to need medical treatment, but the Joint Tuberculosis Council considers that acceptance of this definition should be dependent on introduction of an intimation procedure." It is the Council's intention to prepare a memorandum on this subject.

It was reported that the Council had submitted, at the request of the Ministry of Health, a memorandum on the internal administration of hospitals in so far as sanatoria and tuberculosis wards of general hospitals were concerned.

The next meeting of the Council will be held on the May 19, 1951.

INDUSTRIAL INJURIES ACT

TUBERCULOSIS BENEFITS PRESCRIBED FOR CERTAIN NURSES AND OTHERS FROM MARCH 1

DR. EDITH SUMMERSKILL, Minister of National Insurance, has announced that from March 1, 1951, nurses and certain others whose occupation brings them into close contact with tuberculous infection will be entitled to benefit under the Industrial Injuries Act if they contract tuberculosis as a result of their employment. All forms of the disease, not only of the lungs, are covered.

Those who are already suffering from tuberculosis on March 1 may be entitled to benefit from that date if they have been employed, at some time since July 5, 1948, in nursing or one of the other occupations covered. They should send a claim as soon as possible to their local National Insurance Office, where a special leaflet (N.I.60) giving full details is now available.

EARLY DETECTION OF TUBERCULOSIS

Ministry's New Display Set

A new Ministry of Health display set is centred around the fact that a victim of tuberculosis has a good chance of recovery, particularly if the disease is detected early enough.

The set, which is entitled " Caught in Time: A case of T.B.," is the fourth prepared for the Ministry by the Central Office of Information in the series on preventing disease. It is to be shown in welfare centres, institutes, hospitals, factories, and public libraries, among other places.

The display tells the story of John Smith, who consulted his family doctor for a persistent cough, was sent to the Chest Clinic and found to be in the early stages of tuberculosis. He is shown being treated first at home and then in a sanatorium, and is finally restored to health. The importance of mass radiography for the early detection of tuberculosis is stressed and there is emphasis on the protective value of healthy living.

One of the twelve panels of the set shows how the weekly figure of deaths from tuberculosis has declined from nearly 700 in 1931 to under 400 in 1949, mainly due to earlier detection combined with improved methods of treatment.

THORACIC SOCIETY

The Annual Meeting of the Thoracic Society is to be held in Dublin on July 13 and 14, 1951. The programme includes a discussion on "Acute Tracheo-Bronchitis," one on "The Natural History of Bronchiectasis," and a number of short papers.

The British Journal of Tuberculosis

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CONTENTS

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The British Journal of Tuberculosis and Diseases of the Chest. Quarterly. Single copies 5/6, *post free* 5/8. *Annual subscription* 20/- (*U.S.A.* $3.75)

Notice to Contributors

The British Journal of Tuberculosis and Diseases of the Chest is intended for the publication of papers on all aspects of tuberculosis and cognate subjects. Papers dealing with original work are especially invited.

All manuscript and editorial communications should be sent to the Editor, Dr. Philip Ellman, F.R.C.P., 86, Brook Street, Grosvenor Square, London, W.1. Papers accepted for publication become the copyright of the *Journal* and permission for republication elsewhere must be obtained from the publishers. Papers are accepted on the understanding that they are subject to editorial revision and that they are contributed to this journal only.

Manuscripts, which should represent the final form of the material, should be typewritten in double-line spacing with wide margins. Hand-written corrections must be legible and should be kept to a minimum.

References should be cited in the text thus: Smith (1948); and the list of references given in alphabetical order at the end of the paper, thus: SMITH, X. Y. (1947): *Brit. J. Tuberc.*, **12**, 73. The titles of journals should be abbreviated according to the World List of Scientific Periodicals.

Photographs and photomicrographs should be printed on glossy paper and should, if possible, be larger than the size desired for reproduction. X-ray films should not be submitted, but prints of them (preferably negative prints). The area to be reproduced (if less than the whole) of each photograph should be indicated on the back. Not more than six photographs can be accepted for any one article unless by special and exceptional arrangement. Drawings and diagrams should be done in *black* ink on Bristol board or stout white paper. Legends to illustrations should not be attached to photographs or drawings but should be typewritten on a separate sheet of paper.

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